

POPULAR SCIENCE

MONTHLY

JANUARY
15 CENTS

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See Page 43

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A Marvel
of Science
and Skill

IT may never be your pleasure to actually see specimens of deep-sea animal life . . . even under a microscope. They are too difficult to procure. That is, for most of us. But thanks to the infinite skill and patience of these two artists and Professor R. W. Minor, of the American Museum of Natural History, all the world can now appreciate tiny and once unknown organisms from the depths of the ocean.

*Now
on the,
Screen!*

WITH SOUND
AND COLOR

Produced in Cinecolor by Carlisle & Fairbanks with the co-operation of the editors of Popular Science Monthly

Caught through the high-powered lens, amazing detail is painstakingly reproduced on paper . . . one million times larger than the actual specimen! Then the "portrait" finally finished, it goes to Hans Mueller, world's most unique glass blower, for the stupendous task of fashioning the anatomy of these strange, minute creatures in glass. Absorbing as is this sequence in the new release of "Popular Science"—Paramount's series of sound-and-color movie shorts—it's only a part of the fascinating picture. You'll see a new method of finger-printing, a new radio facsimile recorder, new giant airliners that are sky hotels in their appointments, new beauty aids for the ladies. Don't miss this new "Popular Science"—at your favorite theatre.

"**POPULAR SCIENCE**"

a Paramount Picture





"Jim Called Up Today"

TIME and distance may prevent your being there in person. But you can always be there by telephone, with a warm and friendly greeting. For across the miles your voice is you!

It's easy to do and it can mean so much. A few words—thoughtful, kindly, reassuring—may gladden a day or a life. Somewhere today—perhaps this hour—some one is wishing you'd call.

BELL TELEPHONE SYSTEM



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ALDEN P. ARMAGNAC, *Associate Editor*
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POPULAR SCIENCE

FOUNDED MONTHLY 1872

VOLUME 130 · NUMBER 1
15 Cents a Copy · \$1.50 a Year
Published Monthly by
Popular Science Publishing Co., Inc.,
353 Fourth Ave., New York

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January, 1937. Vol. 130, No. 1. *Popular Science Monthly* is published monthly at 353 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. A. L. Cole, President and Treasurer; R. C. Wilson, Vice President; John Nichols, Vice President; C. D. Freeman, Vice President; F. W. Briggs, Secy. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1936, by the Popular Science Publishing Co., Inc. Single copy, 15 cents. Yearly subscriptions to United States, its possessions, and Canada, \$1.50; foreign countries, excepting Canada, \$2. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address. The contents of this magazine must not be reprinted without permission. The editors are not responsible for unsolicited contributions, and cannot guarantee the return of such material or insure against its loss. Contributions not accompanied by sufficient postage will not be returned. In presenting numerous stories of new products of applied science, Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. The use of Popular Science Monthly articles for stock-selling schemes is never authorized.

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Cover Design by EDGAR F. WITTMACK

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♦ NOVEL TOOTH-PASTE CAP

Semi-Mechanical Cotton Picker

Device Spots Phony Money

Speedboat Has Air Rudder

Pocket Tool Cleans Eyeglasses

Electric Device Tests Hearing

Winged Pin Can't Be Swallowed

Air Pressure Sets Veneer

Barrow Scoops Up Snow

Portable Outfit Analyzes Gas

Pedestrians Get Honking Cane

Dust Mask Has Emergency Filter

New Amphibian Lifeboat

Apparatus Grades Milk by Color

Make-Up Kit Has Lighted Mirror

Baby Tractor Guides Itself

Fuse Clamps Give Tight Joint

Spreads Torch Flame

Stilts Make Portable Bleachers

Air Sampler Reveals Dust Peril

UNUSUAL FACTS AND IDEAS

Dive for Naval Shells

Television Studio Opened

Live Wasps Stored in Bottles

Babies Get Gasproof Shelters

Mobile Railway Power Plants

Crystals Yield Secrets of Iron

Bridge Blasted to Pieces

Huge Ball Plugs Water Pipe

Observatory Built by Students

Streamline Cycle Makes Record

Carves Soap Figure of Bear

Ear Is Radio Speaker

"Lunch Wagon" Serves Dogs

Machine Tests Wear of Fabrics

Bathtub Serves as Radiator

Ship's Stowhold Is Above Deck

Piano Keys from Elephant Tusks

Smelt Create Fishing Carnival

Glue Holds Home Together

Corn Kernels Test Heredity

♦ AUTO REFLECTORS TRIM HANDBUG

Giant Lighting Switchboard

Reveals How People Walk

Artificial Sun Helps Plan Home

May Teach Golf by Television

Electric Eye Aids Chemists

World's Biggest Animal Trap

Home Science Stunts

CRAFTWORK

Amusing Moon-and-Owl Lamp

Hand-Wrought Andiron Set

Tree-Shaped Nut Bowl

Modern Book Ends of Brass

Novelties from Tooled Metal

IDEAS FOR THE HANDY MAN

Walnut Corner Cupboard

Toy Target Registers Anger

Adding Countershaft to Lathe

Bookshelf from Radio Cabinet

Countersink Bit Flares Tubing

Boards for Duplicate Bridge

Handy Holder for Erasers

Homeworkshop Guild News

Design for a Tie Rack

Mail Box Announces Postman

Wire Snake Is Lifelike

Powerful Metal-Cutting Shear

"Hobo Hank" Whittling Kit

Refinishing Interior Walls

One-Man Portable Scaffold

House Lighting Switches

Icing Tool Points Up Bricks

Workshop Plans in Brief

Indoor-Reading Thermometer

Readers' Workshop Projects

Measuring Paper Thickness

Home-Workshop Blueprints

Aluminum Paint for Xmas Tree

Conduit Helps Make Furniture

Prizes for Trailer Kinks

*Now You can use
GENUINE 23-KARAT
GOLD LEAF
In Your Home Workshop*



**The Hastings Home-Workshop
GOLD LEAF KIT
\$5.00 POSTPAID**



Here it is—just what you have wanted to add that "finishing touch" to the many things you make in your home workshop! A practical, complete, low-cost Kit of Hastings Genuine 23-karat Gold Leaf, with full, easy-to-follow instructions for gilding on wood, metal, or any surface that will take paint—and for suggested uses. Made and guaranteed by Hastings & Co., America's oldest gold leaf manufacturers.

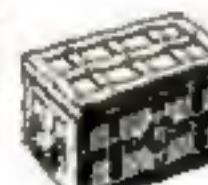


Give your models and miniatures that professional finish. Decorate them with genuine gold leaf. Unlike so-called "gold" paint or bronze powder, gold leaf never tarnishes because it is made from genuine 23-karat solid gold, beaten so thin that one ounce of gold will cover an area of 200 square feet! It's fascinating to work with. So thin and delicate, you have to handle it with your breath. So

brilliant and permanent, you'll want to put it on everything in sight! On your Fisher Body Guild coaches, your canoe, your book ends, your radio cabinet—on any of the 101 different useful articles and novelties that you make.

You can make money with the Hastings Home-Workshop Gold Leaf Kit, too—for the art of gilding is profitable. But buy the Kit for your personal satisfaction and as a long-needed accessory for your own workshop. No shop is complete without it. And look what this Kit contains:

25 Sheets of Transfer Gold Leaf (Genuine 23-Karat; 3 1/8" x 3 1/8")
25 Sheets of Loose Gold Leaf (Genuine 23-Karat; 3 1/8" x 3 1/8")
1 Can of Oil Size (Slow Drying)
1 Can of Japan Size (Quick Drying)
1 Lettering Brush
1 Stripping Brush
1 Gilder's Tip
6 Paint Cups
1 Easy-to-Follow Instruction Book



MONEY-BACK GUARANTEE: If you are not entirely satisfied that the Hastings Home-Workshop Gold Leaf Kit can be useful to you, return it within five days of its receipt and your money will promptly be refunded. These Kits are sold only by Hastings & Company and only by mail. So—

RETURN THIS COUPON TODAY

(Or order by letter)

HASTINGS & CO.,

821 Filbert Street, Philadelphia, Pa.

I enclose \$5.00, for which please send me, postpaid, The Hastings Home-Workshop Gold Leaf Kit with full instructions and 101 suggested uses. If I am not entirely satisfied, I shall return the Kit within five days and my money will be refunded.

(PRINT PLAINLY PLEASE)

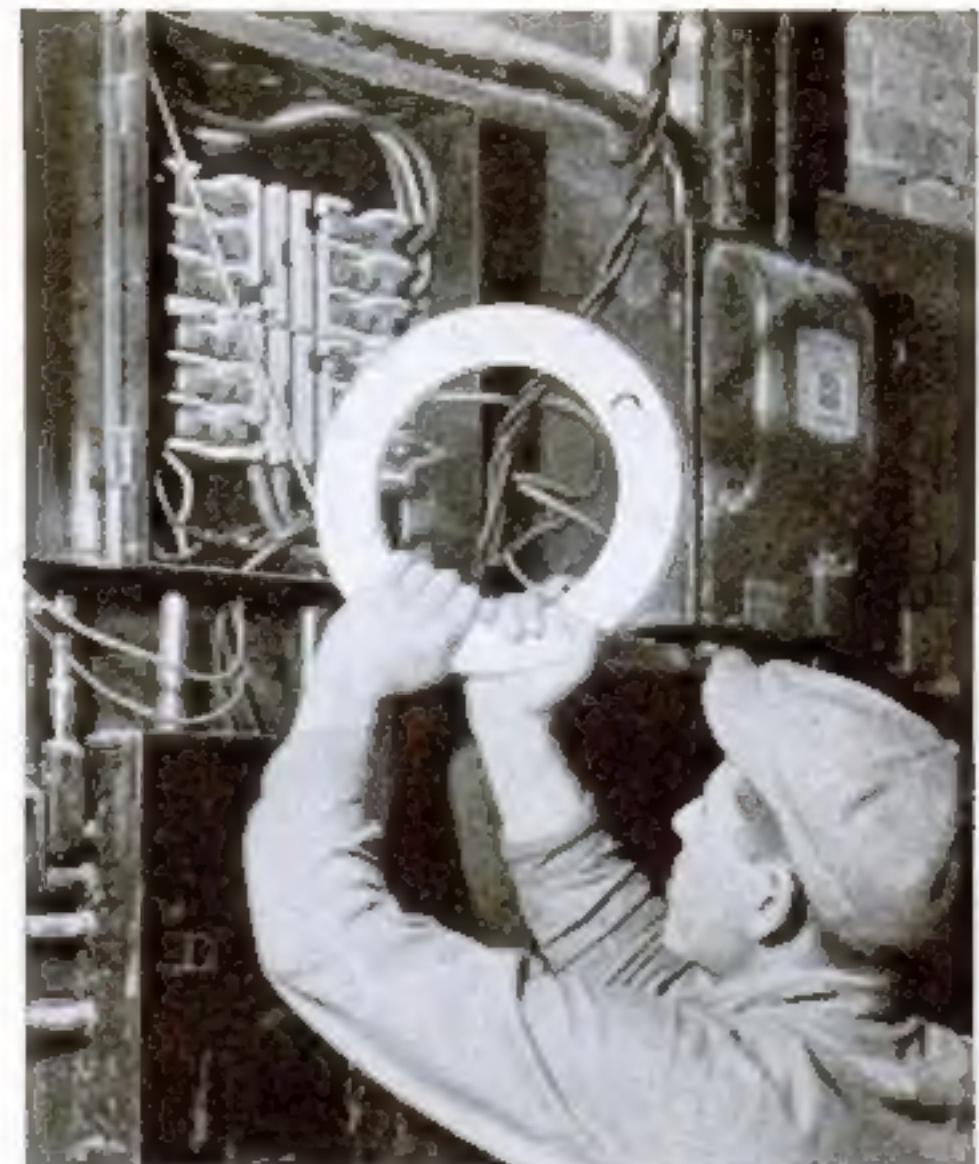
Name _____

Address _____

City & State _____

Check here if you prefer C. O. D.
(\$5.00 plus postage)

Handy Aids for Home Repairs



In use, this fish-tape reel provides a handy grip for pulling new wires through a conduit

through, the tape is rewound automatically, the reel maintaining a constant tension and locking to prevent unwinding.

VALVE HELPS FORCE PUMP CLEAR CLOGGED DRAINS

CLOGGED DRAINS can be opened easily if a new rubber valve is used with the regular plumber's force cup. Placed over the drain opening, the device allows air to be drawn from the pipe but prevents air from entering, creating a vacuum that pulls a hole through the matter that is causing the stoppage.



How valve is used to create a vacuum in a drain



LAMP-SHADE MOUNTING MAKES REMOVAL EASY

GLASS lamp shades can be quickly detached for cleaning when a new-type mounting consisting of a special socket, a three-arm bracket, and a metal dome is used. To fasten the shade, it is necessary only to hang it on the bracket and press the dome down over the socket.

NAILS SEAL HOLES IN METAL ROOFING

CAPABLE of being driven through heavy, lapped metal roofing, these new lead-headed steel nails seal the nail holes to prevent leaks and rust. Completely encased in soft lead, the head flattens out under the hammer blows, filling in all cracks and crevices around the nail.



Questions

FROM HOME OWNERS

Q.—ALTHOUGH I always shut off and drain the water when I leave my house during extremely cold weather, I still have trouble with frozen pipes. What can I do to prevent this?—O. R. C., Bismarck, N. D.

A.—TO PREVENT freezing, water should be emptied from the pipes through a drain cock installed at the lowest point in the water supply system. Usually this point is where the intake pipe enters the house. All faucets should be left open while the system is being drained off, so that air may take the place of the water and thus insure the removal of all water in the piping. Pour two quarts of kerosene into each closet bowl, and one pint into each sink, bathtub, and washbowl to prevent traps from freezing and bursting.

COLORING LIGHT BULBS

A. F., SANTA MONICA, CALIF. Electric-light bulbs can be colored by dipping them in ordinary water glass containing a water-soluble aniline dye of the desired color. The tinted coating should be applied very thin, and should contain some non-drying material, such as glycerine, to prevent the cracking which would otherwise occur.

EASY TEST FOR SEWER GAS

Q.—FOR some time I have noticed a cellar odor that seems to be sewer gas. Is there any way I can make sure of this?—F. L. K., West Haven, Conn.

A.—SOAK unglazed white paper in a solution made from one ounce of lead acetate mixed in a cupful of distilled water. When the paper dries, hang it up in the cellar. If the paper turns black, it will indicate that sewer gas is present.

HOW TO POLISH PEWTER

W. S. L., LACONIA, N. H. Pewter mugs or pitchers can be polished by rubbing whiting on the surface with a piece of soft leather. To make pewter look "antique," bathe it for a few seconds in an alum solution containing a few drops of hydrochloric acid.

MAKING WALL PAPER WASHABLE

Q.—IS THERE any easy method of making wall paper washable?—R. C. S., Ada, Okla.

A.—SPONGE the wall paper with a solution of one part borax and one part shellac in twelve parts of water. Strain the mixture before applying, and, when the paper is dry, polish it to a glossy finish with a soft brush.

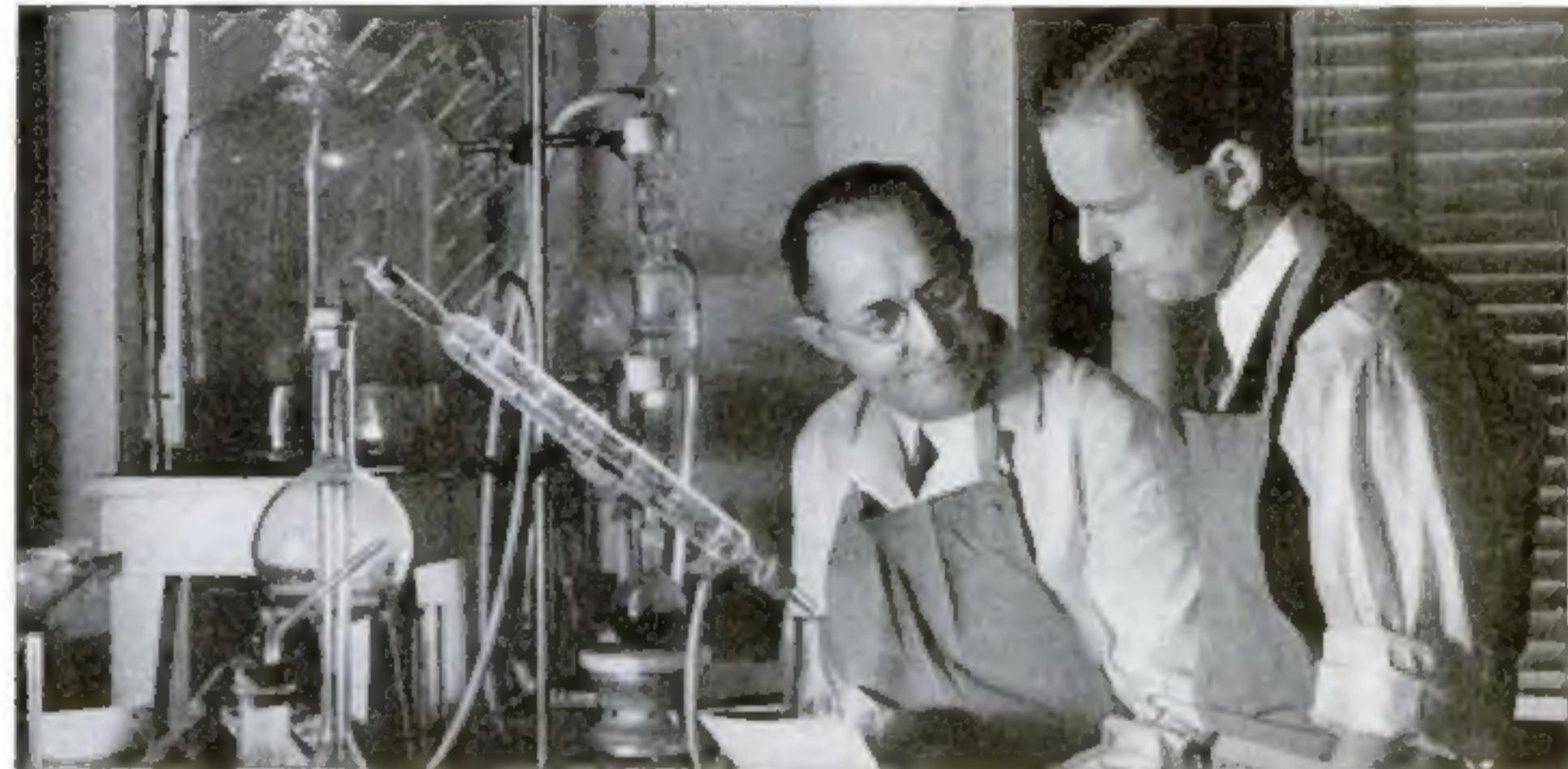
RUSTPROOF IRON PIPES

J. L., ERIE, PA. To protect iron pipes from rust for an unlimited time, coat them with tar and sprinkle on a layer of sawdust. Set the sawdust afire, and let it burn out. As a safety precaution, treat only a small section of the pipe at a time.

DUSTPROOFING COAL

G. R. D., BATTLE CREEK, MICH. A commercial method of dustproofing coal can be adapted for use in homes equipped with coal-burning fireplaces. Mix about three pounds of calcium chloride in a gallon of water, and spray the coal thoroughly with a whitewash sprayer. If you are treating only a small amount of coal at a time, the solution can be sprayed on with any bulb-type atomizer.

Tests prove ZERONE protects even at 215° BELOW ZERO



MEN who take good care of their cars and who keep a smooth-running powerful engine under the hood will be interested in the tests that prove "Zerone" is the anti-freeze that will give them the performance they want in cold weather.

Du Pont scientists dropped the temperature to 215° below zero and found that even this extreme cold failed to freeze a solution of "Zerone" and water. Winter's never that cold, but you can be sure it won't take much "Zerone" to protect your radiator in the coldest weather you ever will meet.

Road tests prove that a small amount of "Zerone" in your radiator

all year round actually improves engine performance. This is because "Zerone" and water pass off heat even better than water alone.

"Zerone" in a clean cooling system also gives year-round protection against rust and corrosion. Write to du Pont for an interesting free booklet "A New Way to Get More Power from Your Car."

Look for the "Zerone" banner that marks the "Zerone" dealer in your neighborhood. Let him give your car *complete radiator protection* with *this du Pont product* that costs only \$1 a gal., 25c a qt. E. I. du Pont de Nemours & Co., Inc., "Zerone" Sales, Dept. P2, Wilmington, Del.





Here's why
MASONITE TEMPERED PRESWOOD
is the leader in
trailer materials



MANY of today's finest trailers are made almost entirely of MASONITE TEMPERED PRESWOOD — because — this modern material answers the three vital problems in trailer construction:

STRENGTH — Both grainless and moisture-resisting. MASONITE TEMPERED PRESWOOD withstands constant stress and strain — as well as exposure to the elements — without warping or cracking.

LIGHT WEIGHT — Since these boards are made of natural wood fibers, held together only by natural lignin, their weight is considerably lower than other less durable materials.

BEAUTY — As shown in the illustration above, the natural finish of MASONITE TEMPERED PRESWOOD is ideal for interior walls and ceilings. Nor does it require additional treatment for exterior surfaces, but can be varnished, painted or enameled if desired.

For achieving extra satisfaction in building trailers, or any other articles that require hard, smooth surfaces, be sure you know the advantages of MASONITE TEMPERED PRESWOOD. Mail the coupon below for FREE samples and further details.

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OF A THOUSAND USES



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111 W. Washington St., Chicago, Ill.

Please send FREE sample and more information about MASONITE TEMPERED PRESWOOD.

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Address _____

City _____ State _____

Model of U. S. S. *Indianapolis*, used by the President for long voyages



PACKAGED MATERIALS FOR BUILDING

Ship Models

Cruiser "Indianapolis," frigate "Old Ironsides," and many historic craft included in our construction kits



A side view of the same model, made from our Kit H

THE increasing demand for our construction kits shows that more and more ship model makers are realizing that they can save time and trouble by purchasing the raw materials in one package. Before we introduced our kits, many a reader would begin a model only to give up in disgust when he could not obtain some of the necessary smaller items. Now, however, there are twenty-five model ship kits from which to choose, ranging from difficult projects down to very simple ones.

Kits for our larger models are listed under the heading "Standard Ship Model Kits." Some of these are elaborate, but the results are worth the effort.

There are ten kits in the Model-of-the-Month series, which we started in 1934 in order to encourage the building of miniature models in sets. For those who lack experience in craftwork and have few tools, we recommend one of these or else one of the three construction sets listed under "Simplified Ship Model Kits."

Complete details about our new "copy-craft" whittling kit are given on page 71.

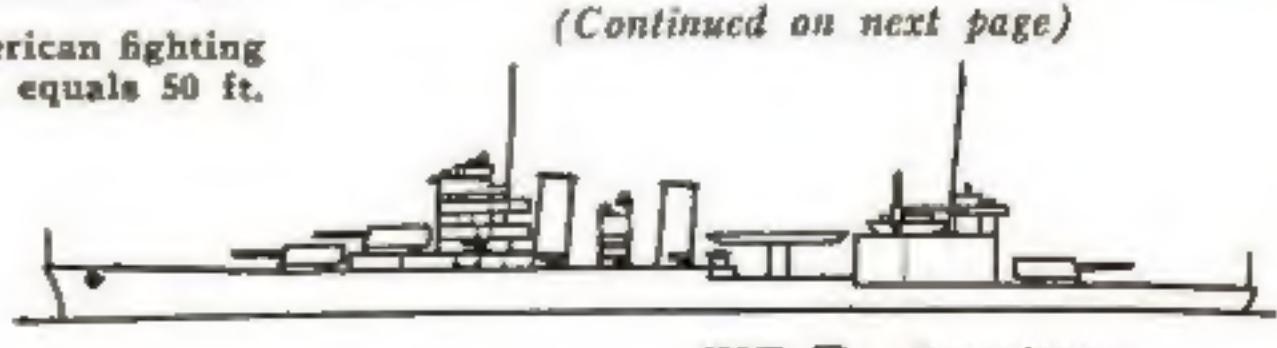
STANDARD SHIP MODEL KITS

- A. Whaling ship *Wanderer*, 20½-in....\$7.40*
- D. Spanish galleon, 24-in..... 6.95*
- E. Battleship U.S.S. *Texas*, 3-ft..... 7.45*
- G. Elizabethan galleon *Revenge*, 25-in. 7.25*
- L. Farragut's flagship *Hartford*, steam-and-sail sloop-of-war, 33½-in. hull..... 8.45*
- Q. Privateer *Swallow*, 12½-in. hull.... 4.95†
- V. Clipper *Sovereign of the Seas*, 20½-in. hull 4.95†
- Y. Trading schooner, 17½-in. hull.... 4.90†
- 2S. U. S. Navy Destroyer *Preston*, 31½-in. hull 5.95*
- 3S. *Constitution* ("Old Ironsides"), 21-in. hull 6.50*
- 4S. Clipper ship *Great Republic*, 31½-in. hull 8.40*

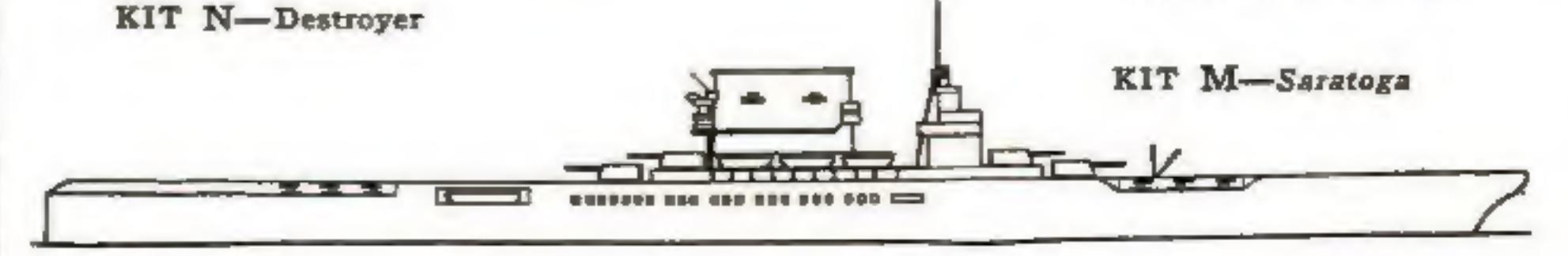
Here is a fleet of outstanding American fighting ships, all built to a scale of 1 in. equals 50 ft.



KIT N—Destroyer



KIT R—Tuscaloosa



KIT M—Saratoga

KIT 5S—All necessary raw materials and full-size blueprints for building our recent 20½-in. long model of a Coast Guard boat

- 1M. Show boat, illuminated, 14-in..... 1.50
- 2M. Ocean freighter, 14-in..... 1.50
- 3M. Yacht *Nourmahal*, 8½-in..... 1.00
- 4M. Oil tanker, 14-in..... 1.50

SIMPLIFIED SHIP MODEL KITS

- F. Liner S.S. *Manhattan*, 12-in..... 1.00
- H. Cruiser U.S.S. *Indianapolis*, 12-in. 1.50
- J. Clipper ship *Sea Witch*, 13-in..... 1.50

MISCELLANEOUS

No. 4. Solid mahogany book trough 22½ in. long, 9½ in. wide, and 24¾ in. high over all. Ready to assemble, with finishes..... 5.30*

(Continued on next page)



Constitution model built from KIT 3S

OUR CONSTRUCTION KITS

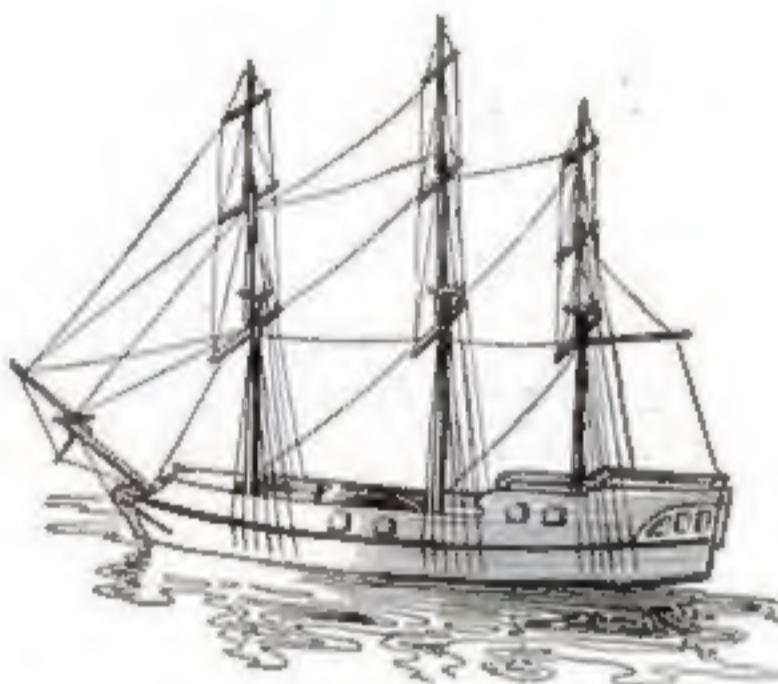
(Continued from page 6)

No. 5. Solid rock maple hanging wall rack with one drawer, 19½ in. wide, 33¾ in. high. Ready to assemble and stain included..... 5.75*

No. 7. Whittling kit with two shaped blocks for making sea captain 5½ in. high. A knife, three bottles of paint, pocket sharpening stone, and instructions are included..... 1.50

No. 8. Whittling kit for six different Scotties. Each is 2 by 2¼ in., sawed to shape. Paint, paintbrush, instructions, etc..... 1.00

No. 9. Whittling kit with shaped block for making a sailor 5¼ in. high. Three bottles of paint, a brush, and a sharpening stone are included75



KIT U—Hispaniola of "Treasure Island"

No. 10. Copycraft whittling kit for making one of several Hobo Hank novelties. Contains a master model of tramp's figure, 5¾ in. high, showing every knife cut; also the necessary whittling block, extra wood for making a desk set, pipe rack, or other project; sharpening stone, brush, three bottles of paint..... 1.50

NOTE: If you live west of the Mississippi River or in Canada, add 50 cents to all prices marked with an asterisk (*) and 25 cents to all prices marked with a dagger (†).

Popular Science Monthly,
353 Fourth Avenue, New York, N. Y.

Please send me C. O. D. Kit.....

I will pay the postman the price shown above plus a few cents postage in full payment. (Canadian orders cannot be sent C. O. D.).

Name

Address

City..... State.....
(Print name very clearly.)

If you prefer to send your remittance with this order, we will pay delivery charges. Remit by money order, check, or registered mail. This offer is made only in the United States and Canada.

NEW LOW-COST TOOLS BY DELTA



NEW 17-INCH DRILL PRESS

The greatest drill press value ever offered. Has scores of unusual features. Get the full story in the 1937 Delta catalog.



NEW 6-INCH BELT SANDER

Has numerous new features including complete double-sealed ball-bearing equipment, full 6 inches of sanding width. Operates in both vertical and horizontal positions.

NEW 10-INCH BAND SAW

Has balanced enclosed disk wheels, running on New Departure double-seal ball bearings, patented table swinging on widely-spaced double trunnions, micrometer adjustment guides and ball-bearing blade supports above and below the table, with the lower-guide adjustments brought out to the front of the table for convenience and safety—and a full 6-inch capacity under the blade guide—where you need capacity in a band saw.



NEW 4-INCH JOINTER

It has the patented fence that insures sure, free action and unvarying accuracy of the settings, patented swinging dual-control handle that makes control of the fence so convenient.

SEND FOR 1937 CATALOG

It is crowded with interesting illustrations and descriptions of the complete Delta line. Points out in detail the important features of Delta design. And also the new 82-page book No. 3 of "Practical Delta Projects" crowded with new and "out of the ordinary" things to make—with many photographs, working drawings, and easy-to-understand illustrations. Simple, complete instructions make every project easy to follow. Every woodworker should have this book. Send 10c with coupon for Delta Project Book No. 3, 1937 Delta catalog mailed postpaid.

Delta Manufacturing Co.
600-634 E. Vienna Ave., Milwaukee, Wis.

Dept. B137

I enclose 10c (stamps or coin) for which please send me one copy of the new 1937 Book No. 3 of "Practical Delta Projects." Also place me on your mailing list to receive 1937 Delta catalog of quality motor-driven tools. I am interested in Delta Tools for:

Home Shop

Industrial Use

School Shop

Name..... Age.....

Address.....

City..... State.....

Check here if you are a Delta user now.

Our Readers Say



Wonder Who Weighed And Measured That Ohm?

PAGE Gus Mager and the Man with the Net! A "questions and answers" column in one of our local papers defines an ohm as "the unit of electrical resistance, practically 106.3 centimeters long and weighing 14.45 grams, at the temperature of melting ice." Perhaps other readers will be as surprised as I was to learn that an ohm has length and weight. Seriously, however, let me compliment you on your radio articles. I find them very accurate and easy to follow. I like the clear-cut style you have adopted for showing schematics and layouts.—D.H.R., Philadelphia, Pa.



"Heavy-Water" Drinker Is Doing Nicely, Thank You

D.W.P., who inquired as to the fate of the Norwegian gentleman who drank the "heavy water" a year or so ago, will be relieved to know that at last reports Prof. Klaus Hansen was still enjoying the best of health. At least two Americans have also sampled "heavy water." Prof. Harold C. Urey, of Columbia University, and Dr. G. Failla, of New York's Memorial Hospital, accuse Prof. Hansen of being less than a connoisseur of its flavor. Failing to notice the "dry, burning sensation" that he reported, they declared the strange beverage tasted exactly like plain distilled water. Research on "heavy water" has been spurred by its curious biological effects, including the fact that it is apparently poisonous to small fish and plants. D.W.P.'s curiosity concerning its properties should be satisfied by interesting results before long.—H.H., New York City.

A Chinese Reader Hands Us A Question About Hands

I HAVE been wondering why it is that we naturally use our right hands more than our left. Is it because we are taught to do so, or because of hereditary instinct? Can somebody give me an answer in the Our Readers Say pages?—J.L., Chefoo, North China.

Martyr to Mathematics Envies "Painless" Pupils

WELL, I guess I was born just about thirty years too soon. When I read, in your December issue, about the way kiddies now learn their arithmetic "painless" from blocks and marbles, I thought how much I went through in learning to add, subtract, multiply, and divide. Especially multiply; I never did learn the table of "nines," and couldn't tell you today what nine times eight is, or are, without counting it out on my fingers. More power to the child psychologists, if they can take the sting out of the most deadly of the "three Rs."—H.G.P., Bangor, Me.



Believe It or Not, Sir Isaac Newton!

I KNOW that your readers will be interested in a natural phenomenon that I witnessed last Sunday. With some friends I went to a place just outside of Morristown, N. J., on the road to Mount Freedom, and with my own eyes saw the law of gravitation defied by having an automobile run uphill with its motor stopped and the ignition cut off. About three miles out, there is a fairly steep grade that slopes away from Morristown. If you stop your car on the grade, take it out of gear, cut the ignition switch, and take your foot off the brake pedal, the car will start rolling backward up the hill and keep on until it reaches the top. I tried it in a car weighing 4,200 pounds empty, with four heavy passengers in it. When we got to the top of the hill, where the "pull" stopped, it was going three miles an hour. It certainly was a weird and uncanny feeling to roll uphill, either forward or backward, with no power at all. Can any of your readers explain this phenomenon?—B.L.L., Rahway, N. J.

Reader Pulls a Long Face At Leaf-Cleaning Machines

WHY does H.L., Siloam Springs, Ark., want to suck the leaves off his lawn with a vacuum cleaner, if he's going to use the leaves for fertilizer? If he lets them stay on the lawn, they will make a very effective fertilizer for his grass, and he won't have to think up some other fantastic machine to spread it with. If you publish this letter with a cartoon, don't draw a round face on me; I am not built that way.—S.Z., Chicago, Ill.



Too Much Trigonometry Made It a Long Road

IT APPEARS that G.W.P., Vergennes, Vt., used too much trigonometry in solving the "bee-line road" problem, and got all tangled up in it. The solution requires only the use of a fourth-degree equation, with no trigonometric terms. By Euler's method, an exact solution of any fourth-degree equation is possible. It involves only cube roots and square roots. To add further to the mortification of G.W.P., let me state that it is possible to complete the solution, to five figures, in only an hour and a half. I know it can be done, because I did it.—R.E.M., Portland, Ore.

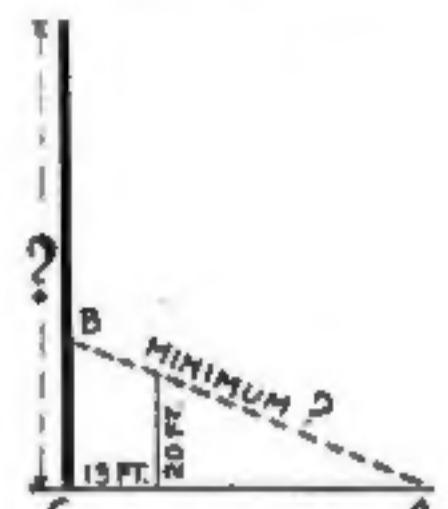
A Star Can't Pull a Wagon, This Skeptic Maintains

I ENJOY your magazine very much, and get a specially big kick out of some of the questions your readers send in, particularly those that involve physical and mathematical theories. The chief difficulty seems to be that these readers keep getting the practical and theoretical mixed up. The theoretical can exist only in the mind, but because they cannot actually witness the thing, many of them fail

to grasp problems which are really quite simple.—G.H., Pendleton, Ore.

The Math Sharks Warm Up For the Winter Season

THERE are two answers to that very interesting problem submitted by R.H., Baltimore, Md., about the broken pole. In one case, the angle that the broken piece makes with the ground can be $75^{\circ} 41' 36''$, making the length of the broken piece 50.7876 feet. In the other case, the angle can be $7^{\circ} 18' 21.5''$, making the broken piece 88.718 feet. I solved the problem by assuming the angle between the ground and the broken piece as the unknown. Solution of the third-degree equation which results gives the angle, and, once you have the angle, the rest is easy. To come back at R.H., suppose that his pole, but now of unknown height, stands thirteen feet behind a fence that is twenty feet high. The wind breaks it, and it is found that the broken piece, which lies over the fence with the tip touching the ground and the broken edges still touching, is the shortest piece that possibly could be placed in such a position. Under this condition, what was the original length of the pole? I'm glad to see that the math sharks are waking up. Winter is coming, and it will be fun to work on all those interesting problems that the readers submit. Here's hoping you have one in every issue.—F.L.M., Aurora, Ill.



But Keep the Stuff Out of Your Flower Garden!

I NOTICE in Our Readers Say that W.B., of Worcester, Mass., wants to get rid of poison-ivy plants. If he will dissolve a pound of calcium chlorate in a gallon of water and sprinkle the solution on the leaves of the plants as fast as they come out next spring, he will kill them—and, incidentally, any other plants that happen to get in the way.—G.M.S., Malden, Mass.

Friend of Electric Plugs Joins S. P. C. H. A.

I HEREBY make application for charter membership in T.R.A.'s Society for the Prevention of Cruelty to Household Appliances. The Brooklyn reader has brought up a subject that has been on my mind for many a year. My own pet peeve is to see some heavy-handed female take hold of an electric extension cord and yank the plug out of the outlet with a pull that would win any tug-of-war. Seems like I spend most of my time fixing plugs that have been loosened by such mistreatment, and replacing fuses that have been burned out by



short circuits caused in this way. Now I see, in your department of "Building Aids for the Handy Man," that somebody has brought out a pullproof plug. Just the same, I say long live the S.P.C.H.A!—J.R., Providence, R. I.

Selfish Motives Keep Snakes Off Mountains, He Says

HAVING read all the books I can find on the subject of snakes, I think I am qualified to say that the beliefs of the Tennessee mountaineers as to why reptiles are not found at high altitudes, are all wrong. The absence of snakes is not due to the balsams that grow on the mountains, but to the scarcity of food. Snake food, which consists of eggs, small birds, fish, frogs, and other snakes, is not found on mountain tops; hence, the snakes stick to the lowlands where they can get a square meal when they want it. During the past ten years, I've climbed many mountains in the Alleghenies of Pennsylvania, but I have never seen a snake on a mountain top; in fact, there is very little animal life of any kind there. In the valleys you see plenty of snakes, even sunning themselves in pine trees. So, I would say that the idea of the smell of evergreens affecting snakes is just another "saying."—J.C.W., Pittsburgh, Pa.

Praise for the Articles on Photo-Engraving

THANKS for publishing those articles by Kenneth Murray on photo-engraving, and thanks to Mr. Murray for handling them in so understandable a manner. Here at the Indiana Masonic Home School, where we print the "Indiana Freemason," we have been trying, for some time to persuade our board of directors to purchase one of these one-man engraving outfits, but as yet they have not seen the way clear to do so. Now we can have one, and at the same time furnish a project for the vocational training department. Small-town and small-shop printers are buying these one-man engraving plants, and we could have placed one of our students last spring if we had had an outfit on which to train him. We also have a call for another one next May, and with your outfit for training we have a good chance to fill that job. Your magazine is a favorite here at the Home, because of the fine articles you carry and the care you put into making them easily understood. "I saw it in POPULAR SCIENCE," is a motto here. Keep up the good work.—Y.B., Franklin, Ind.

Can You Make Your Mind Turn a Somersault?

IT IS a scientific fact that new-born babies see the world upside down because of the inverting action of the iris of the eye. The mind, it is said, learns to interpret what the eye sees, right side up, and we therefore imagine things to be right side up without actually seeing them thus. A photographer, looking at a ground-glass screen, sees the image right side up and imagines it upside down. Try it! The camera lens inverts the image and the iris again inverts it, presenting the image to the mind as it really is. Imagination does the rest, and we see it upside down. Some camera genius ought to try un-imagining the ground-glass vision. Perhaps he will see the image right side up.—M.G., Brooklyn, N.Y.

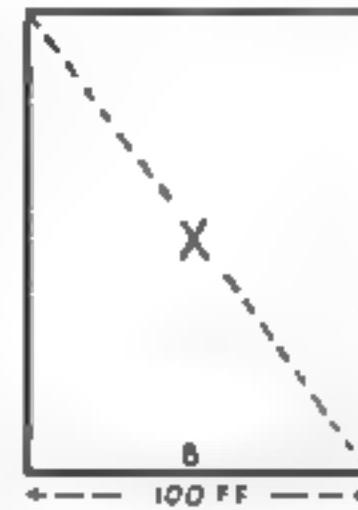


You Have To Learn To Snoop If You Want "Odds and Ends"

I NOTICE that one of your readers complains of his inability to procure the "odds and ends" required for making various projects. "Odds and ends" are like the merchandise in the ten-cent stores, which changes from week to week; you have to buy it when you don't need it, in order to have it when you do. I find it a good idea to accumulate a supply of usable material that I pick up from time to time. I have two cabinets containing about sixty drawers made from brick-cheese boxes, in which I keep a supply of washers, bushings, bolts and nuts, corrugated fasteners, and electrical supplies. Thus I am able to make repairs or replacements around the house at a moment's notice. Also, in a corner of my cellar shop I have bins or boxes to hold the larger junk that I pick up. I make regular trips to the scrap piles in the junk yards, and buy small castings, sheet steel, pulleys, iron rods, angle iron, and so on. Our friend who has difficulty in finding "odds and ends" must live in a very small town, or else he has not learned to snoop around. I might mention that I buy all the mechanical publications, but find in your magazine the most usable material, as well as a fine selection of articles of general scientific interest.—H.L.O., Canton, Ohio.

This Problem Sounds As Easy as Pi

HERE is a simple problem that may provide a few minutes' entertainment for some of your mathematics hounds: A certain rectangle is of such proportions that the ratio of the diagonal to the long side is equal to the ratio of the long side to the short side. If the short side measures 100 feet, what are the other dimensions of the rectangle? I am very much interested in the problems you publish, and also enjoy particularly the articles on chemistry and microscopy, and the Home Workshop department.—F.E.L., San Diego, Calif.



Here's the Enlarger Bellows That M.G. Asked For

PERHAPS I can help M.G., of Brooklyn, N.Y., with his problem of making a simple bellows for a homemade enlarger or other projection device. A serviceable bellows can be made from heavy kraft paper by following these instructions: For a square, parallel-sided bellows, cut the paper twice the bellows' length wide and five times the bellows' width long. Mark off five divisions and fold the first over the second, these two over the third, and so on. The next step is to fold about three fourths of an inch of the open side over, then the two thicknesses back, and so on until the whole resembles a stairway. Open the large folds and cut off part of the first and last segments for joining into a square tube with the seam down the center of one side. All that remains is the shaping of the corners with the fingers so that the part creased outward will fold out, and the corresponding crease on the adjacent side will go inward. It is surprising how easily the segments will assume their proper shape with a little help and, of course, they will retain the shape because of the creases. Several coats of black drawing ink give an opaque and good-looking finish. A tapered bellows can be made by using a trapezoid-shaped cardboard template to mark off the segments on a large sheet of paper before folding. To produce a bellows of rectangular cross section, cut part from the side opposite the seam and from the side with the seam, after folding is completed but before the seam is glued; then join the two halves. For a more



durable bellows, perhaps thin, black leatherette could be glued to the stiff paper at the start.—J.B.D., Jr., Medford, Ore.

He'd Have Us Stuff the Book With Taxidermy Articles

THREE cheers for taxidermy! Your article on pickle-jar museums seems to promise well for the future. Now let's have something about the mounting of furred animals as ornaments for gun racks and other sportsmen's equipment. I know at least a half dozen ardent readers here who would like to see the same thing. Keep up the camping hints, too. By the way, that idea of putting a spotlight on a rifle is an old one out here, also. We use it for rabbits and some other game, but it is illegal for opossums.—G.S., Rosefield, South Australia.



Suggests Noiseless Rails For Streamliner Track

WHEN I read the very interesting description of the proposed safety track for stream-line trains, in a recent issue of your magazine, I thought of a further improvement for the plan. Modern street railways, especially in Europe, are using a special type of rail to reduce noise and eliminate jolts at the joints of rails. This rail has a semicurved running surface and is so constructed that, where two rails join, they overlap vertically. It has been adopted by underground railways like those of Paris and Berlin. This type of rail could be used with Prof. Weisinger's safety track as well as any other rail, and its tendency to reduce noise and shock should be specially valuable for fast streamliners.—E.W., Washington, D.C.

The Model Makers Join The Armament Race

IN A recent issue, you published plans and instructions for making a model of a Civil War cannon. Why not give us a similar article on one of the six or eight-inch guns used on the bow and deck house of the latest-type destroyer? Some of us would like to go into detail in making our models, and a description of these cannons would be of help to us. The three-inch gun mounted on the Coast Guard cutter model, of which you gave an enlarged, detailed description, helped a great deal in making the model more realistic. I believe that many model makers would appreciate further plans and details of modern naval guns.—C.H., Memphis, Tenn.

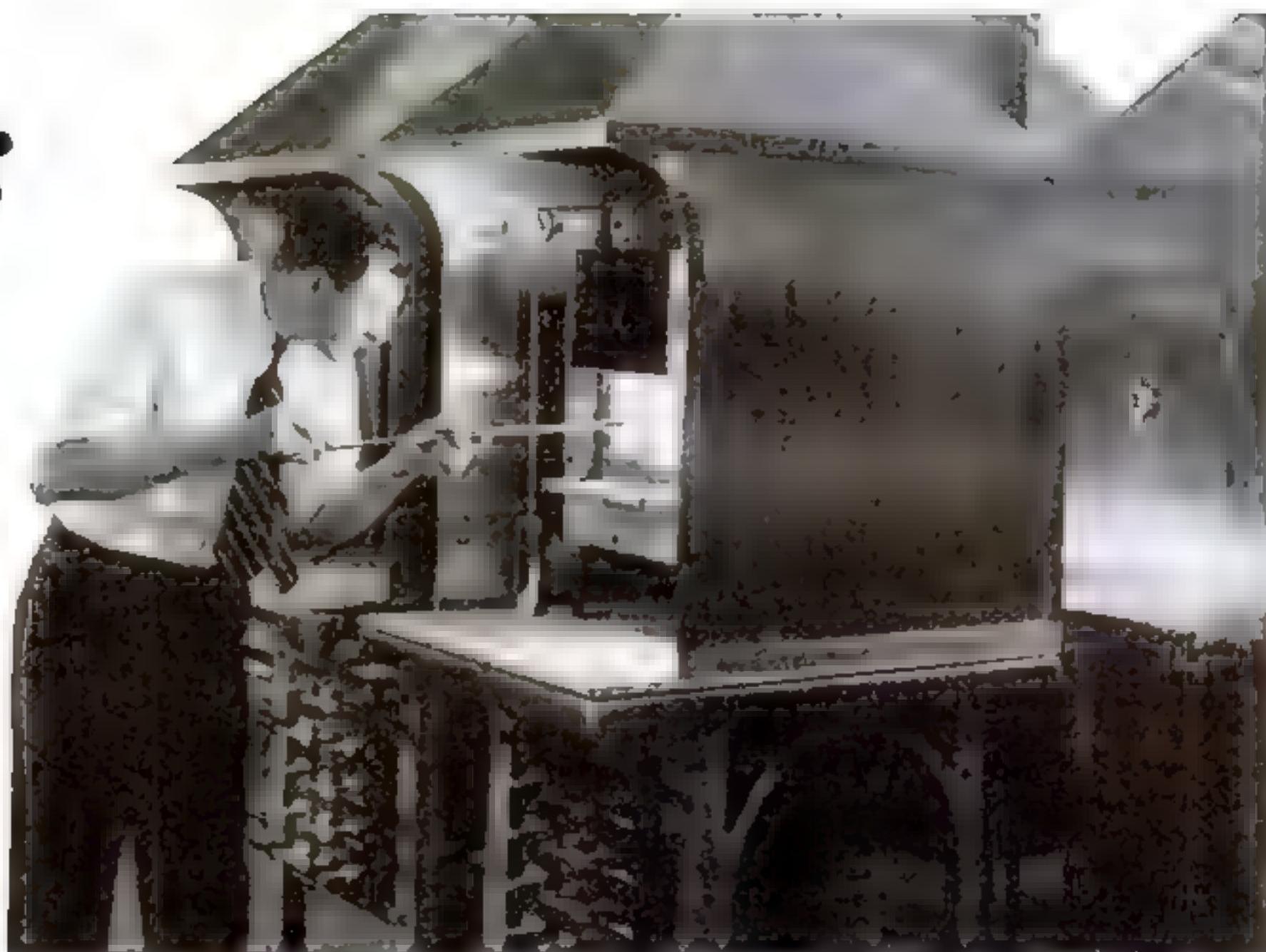
Copying Lens for Camera Solves C.A.W.'s Dilemma

IN A recent issue, C.A.W., of Cincinnati, Ohio, asked for a simple and inexpensive way to make photographic copies of printed matter. If he desires, C.A.W. can buy a copying lens that fits on in front of the regular lens of the camera. I have found that with this equipment small objects can be taken in natural size; if the picture of a page of print is not large enough to be legible, it can be enlarged to any size desired. The copying lens is not expensive. I have used this method for making copies of sections of maps of mountain districts to avoid the inconvenience of having to carry the whole map along.—E.P.H., Sterling, Colo.



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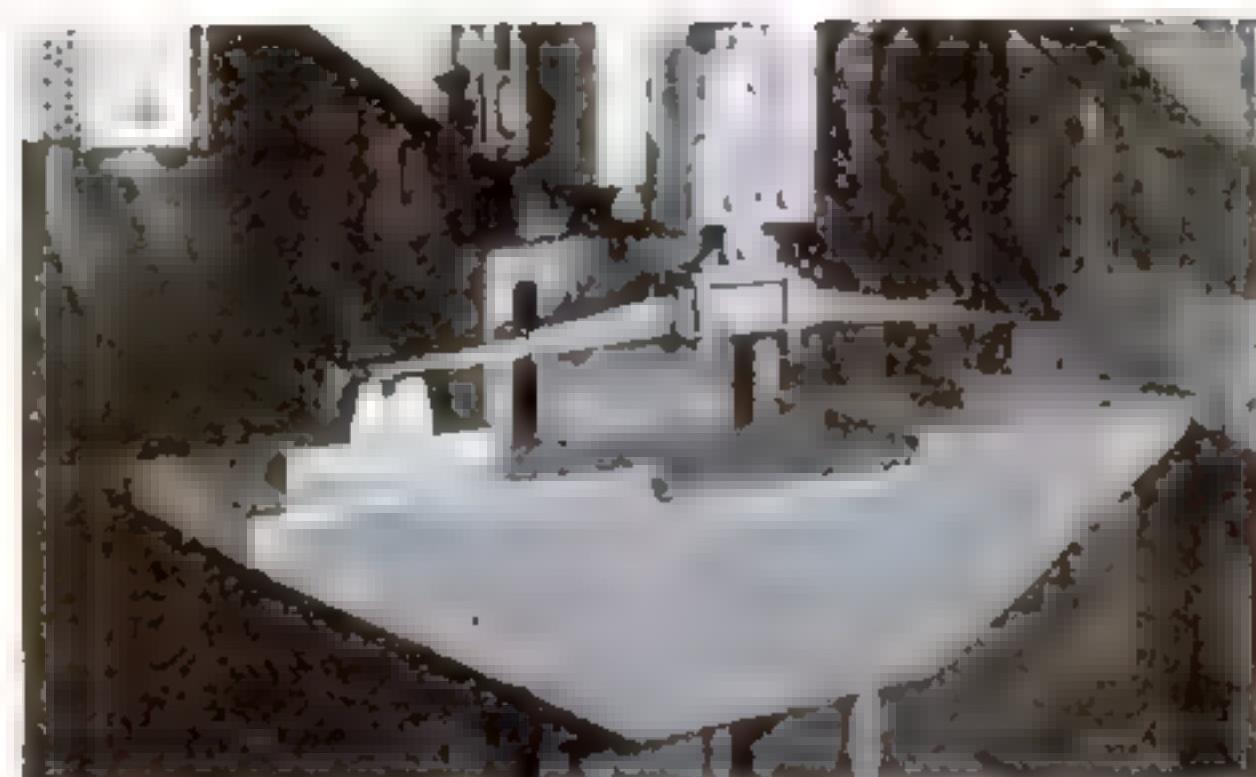
No Wonder GENUINE FORD SPRINGS STAND UP!



Two HUNDRED THOUSAND pounds per square inch! That's the tensile strength of the steel in a Genuine Ford Spring. It's an example of the standards of quality to which Genuine Ford Springs are built.

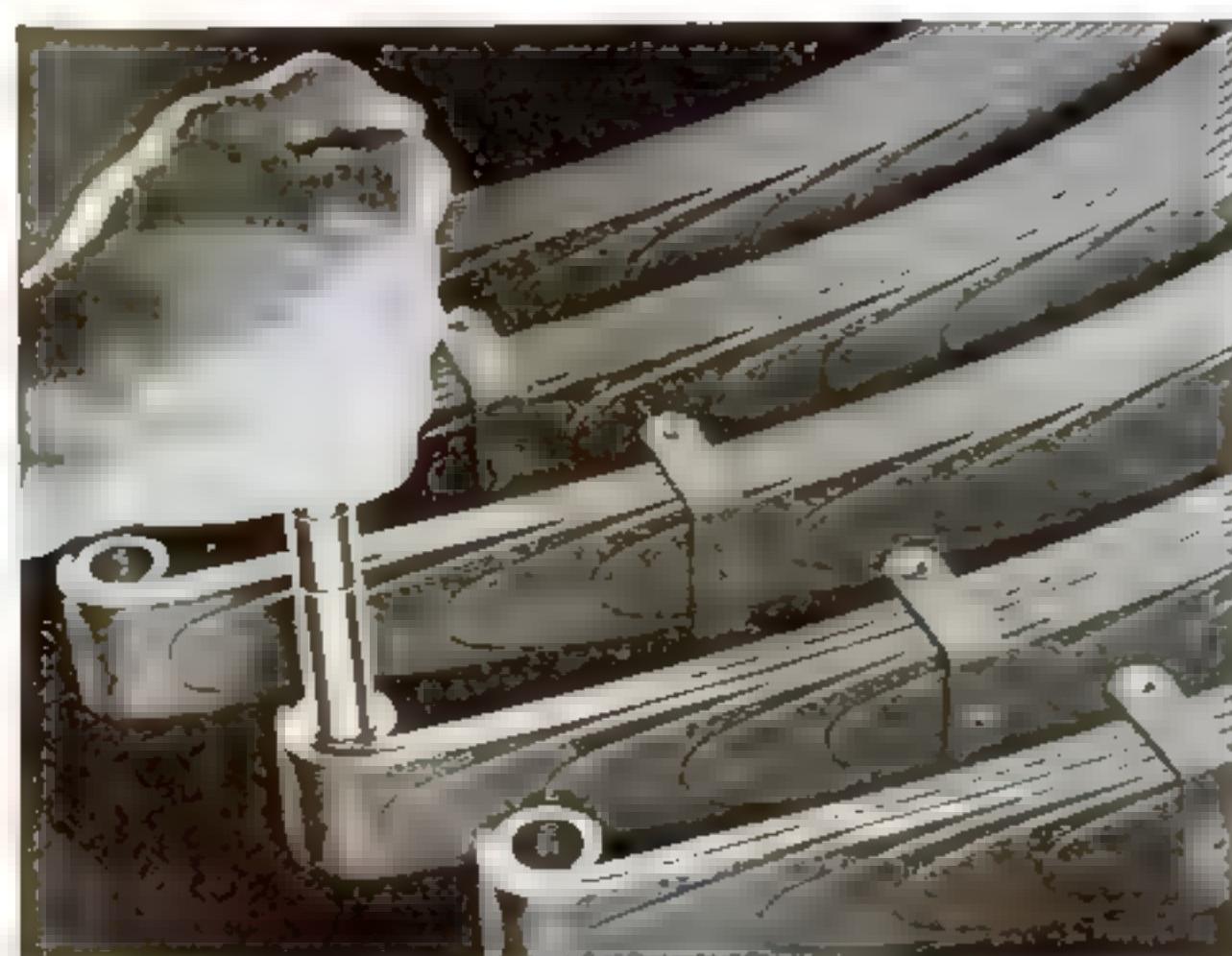
Every batch of steel used in making Ford Springs is carefully analyzed. It must meet rigid specifications established by Ford engineers. Only a high-grade oil-hardened chromium steel is used.

Test springs made up of leaves from the various batches of steel are being constantly subjected to rigorous tests on one of five machines built exclusively for spring testing. And an example of the precision used in manufacturing



(Above) Heating steel sample in electric furnace at Ford Testing Laboratories.
(Below) Fatigue Test equivalent to more than 10 years of usual service.

Springs for 1937 Ford V-8s are provided with an oil groove for interleaf lubrication as shown at left.



Plug gage inspection of Ford Spring eyes.



Genuine Ford Springs is the fact that the inside diameter of spring eyes is held within limits of two thousandths of an inch.

Quality materials, uniformity of materials, precision manufacture, rigid tests and careful inspections — these are the things that insure Ford quality in Genuine Ford Springs as well as all other Genuine Ford Parts. These are the things that have built Ford reputation. These are the things that mean you get full value for the money you spend when you buy Genuine Ford Parts.

FORD MOTOR COMPANY

DEARBORN • MICHIGAN

Monthly

RAYMOND J. BROWN, *Editor*

When the great fleets clash in sea battles of the next war, they will try out countless new weapons that inventors have been forging for them. Tiny submarines, speedboats, and pilotless planes will vie with dreadnaughts for mastery.

New Fighting Ships Change Naval Warfare

PICTURE the mightiest gun ever built—a giant steel tube that outclasses all the Big Berthas of World War memory, hurling an eighteen-inch shell as heavy as a motor car! Then multiply it a few times, and you will have an impression of the armament that is reported under consideration for Uncle Sam's newest battleships. With former limitations removed by the lapse of international treaties, two 35,000-ton ships of the line for which the Navy Department is preparing plans—the first we will have built since 1923—may become the most powerfully armed craft known to history.

War clouds gathering abroad are making great nations look toward their armed services more

than toward their diplomats for national security, and the world is seeing a naval-armament race such as has never before been known. Not in tonnage and caliber of weapons alone, but in refinements of invention and design, world powers are vying with one another to add new power to their fighting fleets.

England has just created a new type of naval vessel with a unique tactical purpose—the "airplane destroyer," whose sole mission is to shoot down hostile planes. Shipyard workers have remodeled a pair of veteran 4,000-ton cruisers, the *Coventry* and the *Curlew*, by cutting down their masts and replacing all their con-

ventional weapons with a thicket of antiaircraft guns grouped in two main batteries fore and aft. The twenty-nine-knot speed of the vessels enables them to accompany ships of the line and to concentrate upon fighting off air raiders while surface fleets fight each other.

More and faster antiaircraft boats are likely to follow. They are Britain's answer to the bad dreams of tacticians who have wondered what a few well-placed air bombs might do to the pride of a country's fighting fleet—and whose qualms have not been lessened by the pilotless, radio-controlled airplanes, ostensibly intended for gunnery practice but capable of carrying bombs, that the British are now catapulting like clay pigeons from warship decks.

By ALDEN P. ARMAGNAC





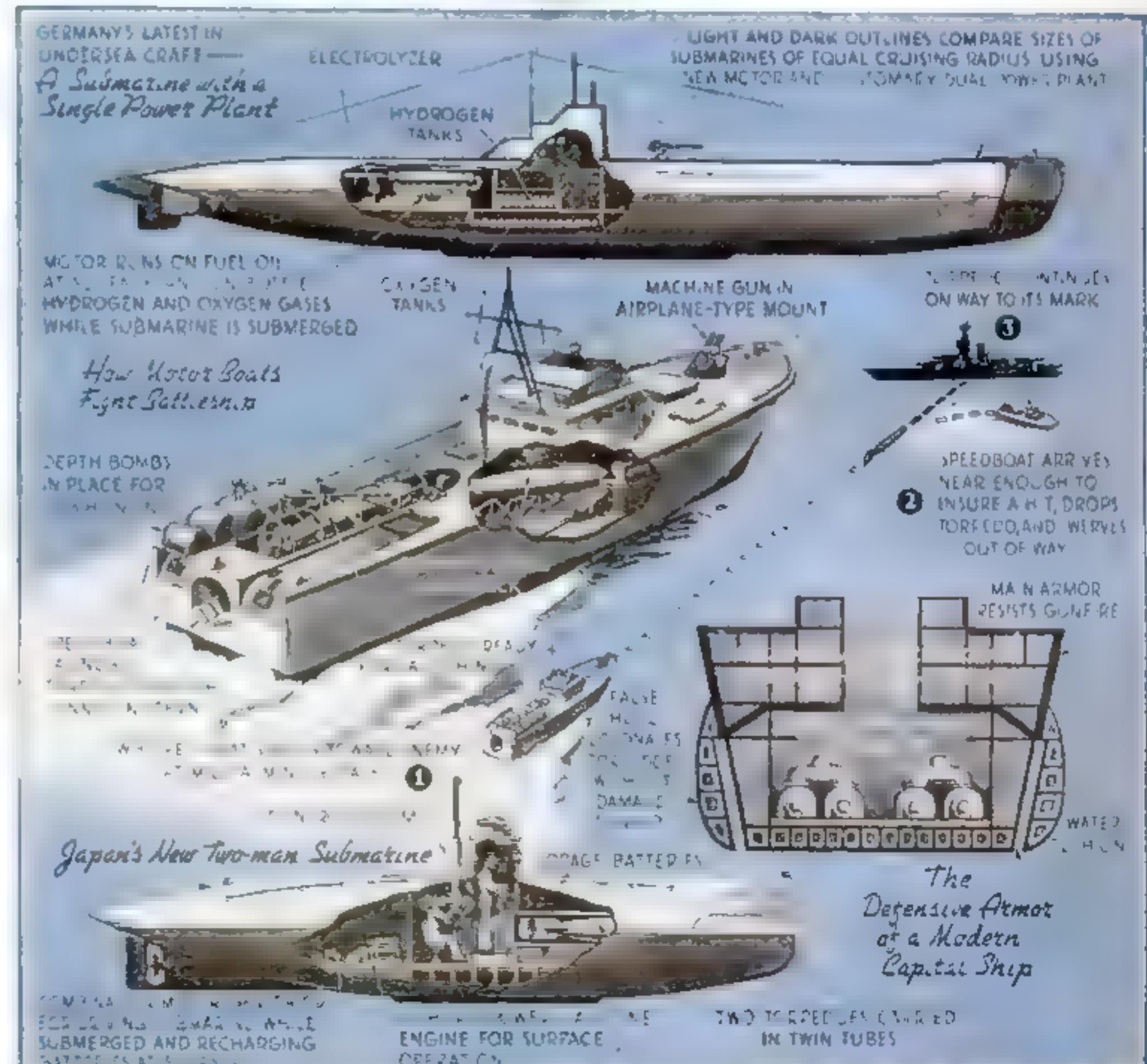
PLANES WITHOUT PILOTS. A radio-controlled airplane being catapulted from the deck of a British warship. Now used for gunnery practice, these pilotless planes could be directed from the mother ship on devastating bombing raids against an enemy

One of the new motor torpedo boats built recently by Britain. Craft of this type are designed to race through raking gunfire until they can launch their deadly missiles with effect

One of the most radical departures in existing types of war craft is embodied in the latest German submarines. Thirty-two of the undersea raiders, according to reports, are equipped with a remarkable new motor that drives them either at the surface or submerged.

Conventional submarines use Diesel motors at the surface and electric motors below, to avoid consuming the air that the crew must breathe. Designers have dreamed of saving space and weight by combining the two power plants into one, and German technicians have now succeeded. On the surface, the German motor uses fuel oil. Submerged, it operates on hydrogen and oxygen gas compressed in bottles. No air is then used up when it runs, and it gives off no telltale exhaust to betray the submarine to surface craft by rising bubbles. The only product of combustion is a few drops of water. When the submarine's supply of fuel gas needs replenishing, it has only to come to the surface and manufacture more. Coupled to the motor, a dynamo produces electric current that breaks up water into the needed hydrogen and oxygen, in a device called an electrolyzer.

Since submarines using the new motors are declared faster than standard craft and possessed of greater cruising radius, a tiny vessel of the German type carries the same war threat as a much larger one with standard engines. In maneuvering, it shows further advantages. There is no limit to the angle at which it can dive, since there are no



Here are four of the revolutionary new developments in naval armaments that may upset all the traditions of sea fighting. Most of the innovations point toward small ships of great speed and power

heavy storage batteries to break loose and fill the craft with poisonous fumes. It cruises under water for record-breaking lengths of time, as the supply of fuel gas that it can carry far outlasts the charge in batteries. Craft of the new design should give an interesting account of themselves in naval war.

"Invisible torpedoes," also of German invention, add to the submarines' threat as raiders. Powered by electricity instead of compressed air, the new projectiles are difficult for a vessel to dodge, no matter how vigilant its lookout may be. They leave no visible trail of air bubbles as they speed toward their target.

Mosquito-sized war craft are adding to the worries of old-line strategists. A few years ago, Germany startled naval designers with

a 10,000-ton "pocket battleship" designed to "lick anything it cannot outrun and outrun anything it cannot lick." Today, miniature torpedo boats, aircraft carriers, and submarines have entered the picture.

When British-Italian relations were strained, not long ago, and naval observers were mentally checking off the relative strength of the British armada and the smaller but highly modernized Italian fleet, one of Mussolini's trump cards was reported to be a squadron of 300 swift torpedo-carrying motor boats. Now England is starting to build up its own mosquito fleet with mile-a-minute craft designed by Hubert Scott-Paine, British motor-boat racer. Each of these whippets of the sea carries two torpedoes. A crew of ten men races the craft toward an enemy vessel, launches a torpedo from the stern, and veers aside while the missile plows on to its mark. No match for heavy batteries, these vessels rely on their zigzagging speed and sheer numbers to get through the raking fire that is sure to be turned on them. In time of war, they would form a "suicide squadron" manned by daring volunteers.

Fighting battleships with motor boats may seem fantastic—but slower and frail prototypes of these armed speed-boats amply demonstrated their prowess when they were tried out by the Allied Powers in the World War. Slipping in through the mist off Pola Harbor in the Adriatic Sea, two torpedo-carrying motor boats manned by daring Italians met and sank the last of Austria's battle cruisers—and this despite the fact that the larger vessel was surrounded by destroyers. The Austrians, although stunned by the audacity of the raid, swiftly gave chase. A destroyer overtook one of the motor boats, but at such close range that its guns cleaved the air high above the skimming target—whereupon the crew of the fleeing raider tossed a depth charge in the path of the bigger ship, and the resulting explosion put the pursuer out of commission. The occupants of both speedboats escaped without a scratch.

An American inventor, Albert Hickman, is believed to be the originator of the idea of torpedo-carrying motor

*Drawings by
B. G. SEIELSTAD*

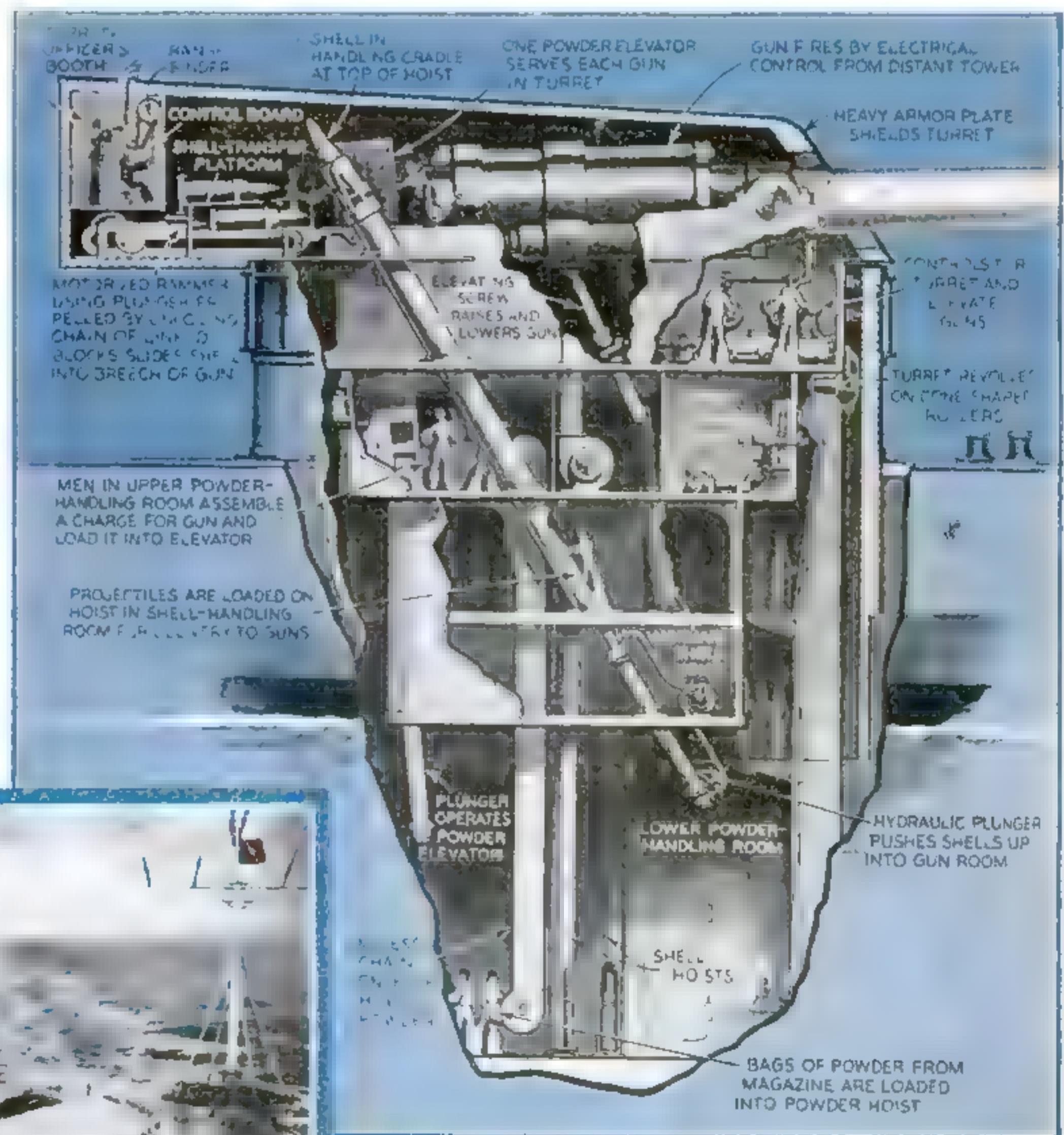
boats—but today the United States is less partial to them than foreign countries. "Getting our Navy built up to treaty strength is more important than experimenting with sea sleds," is the gruff comment of Admiral William H. Standley, Chief of Operations. The story is different in the Philippines, where Major General Douglas MacArthur, former U. S. Army Chief of Staff and now principal military adviser to the Philippine Government, has worked out a plan to make the islands virtually impregnable when they attain their independence ten years hence. With the relatively small sum of \$8,000,000 a year available to spend on armament, he has made the backbone of his scheme a fleet of 100 sixty-mile-an-hour motor boats, fitted with two torpedo tubes and carrying eight men apiece. Backed up by 250 airplanes and a strong land force, the mosquito fleet appears to him so potent that it would take 500,000 men, \$10,000,000,000, and three years to conquer the defending forces—a price that is likely to make any covetous power think twice before making the attempt.

"Pocket" aircraft carriers may be the next development. One of Britain's leading naval designers offers plans for ships

that will carry seven or eight planes apiece. Eight of these carriers would cost less than the 22,000-ton H. M. S. *Furious* and would accommodate collectively the same number of planes. Their speed and maneuverability would make them far more difficult targets for air bombers to hit. Instead of providing a long flying deck, each "pocket" carrier would catapult its planes into the air, and pick them up again on a canvas apron trailing from the stern of the vessel.

Japanese designers have picked up the idea of small-scale fighting craft, and have produced a two-man submarine, only thirty-five feet long and six feet broad, capable of cruising submerged for eight hours at a time. Two of the tiny craft have been built and are now being tried out to test their strategic usefulness.

In the face of these new naval developments, America and England, the world's two greatest naval powers, agree that the majestic battleship remains the mainstay of a fighting fleet. But modern methods of warfare are bringing about curious changes in its design. Swathings of armor to stop high-flying shells and air bombs call to mind the costume of a medieval knight. Queer bulges (*Continued on page 107*)



WHERE THE DREADNOUGHT KEEPS HER THUNDER
Cut-away view of a turret on a modern battleship, showing the complicated mechanism by which the great guns are handled and supplied with ammunition. Left, the German "pocket battleship" *Deutschland* firing the eleven-inch guns of her after turret

How MODERN PATHFINDERS *prepare your* Automobile MAPS

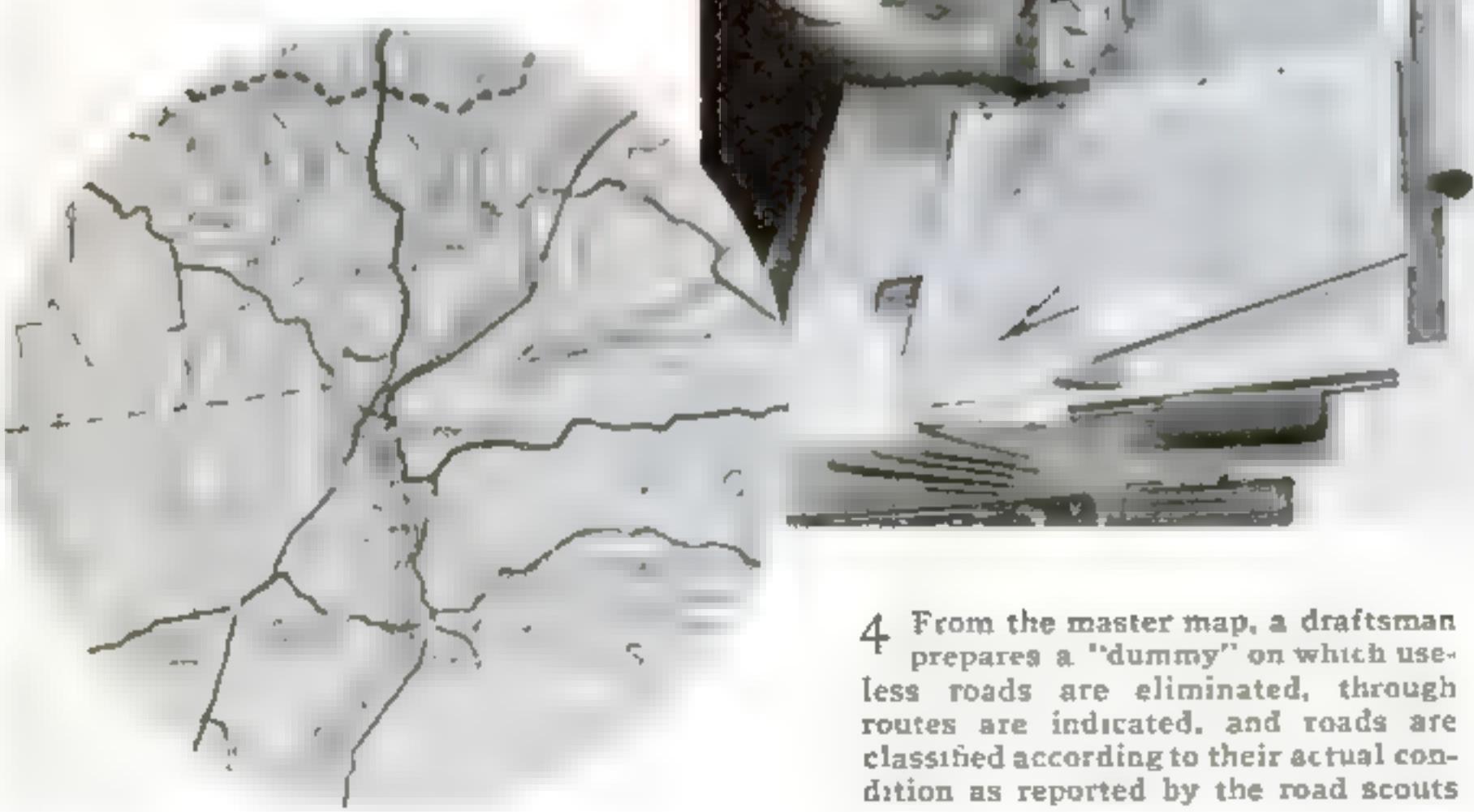


1 Fleets of scout cars, continually cruising over roads in every state, gather information to keep maps up to date. New construction, resurfacing, and elimination of curves are all duly noted for inclusion in the next map.

2 The reports of the road scouts are transferred to filing cards which are catalogued for reference in making up the maps of the various regions for the following year. The average map will require more than 300 changes a year.



3 The basis of the original map is a master chart which is made by assembling U. S. Geological Survey maps, county maps, mail-route maps, and air photos. Highway information from official sources and from observations of road scouts is added as shown, by penciling roads with colored crayons.



4 From the master map, a draftsman prepares a "dummy" on which useless roads are eliminated, through routes are indicated, and roads are classified according to their actual condition as reported by the road scouts.

WHEN the first complete automobile road maps were issued, less than twelve years ago, they were the forerunners of a vast new industry. Last year, more than 50,000,000 highway folders were distributed by the nation's oil companies, and road-map making has become a big business employing the services of aerial photographers, armies of road scouts, and corps of expert draftsmen.

Keeping a road map for a single state up to date is an undertaking in itself. Each year, on the average, more than 300 corrections must be made. New roads have been built, old ones resurfaced, and curves straightened since the 1936 maps appeared. When the 1937 maps are issued, they will contain this information, to give accurate touring data for every section of the country.

Much of the work of keeping road maps up to date is carried on by fleets of scout cars. Driving over the roads of each state, road scouts explore the various automobile routes. Following the existing map, they check mileages and supply eyewitness reports of road conditions and errors in mapping. This information, filed at mapping headquarters, serves as a valuable guide when work on a revised map is begun.

When the map makers start work on a brand-new district and have no previous road chart to revise, information is gathered from every conceivable source. The basic pattern is assembled from U. S. Geological Survey maps, county maps, and local mail-route maps. In territories unaccounted for, airplane photographs fill in the gaps. Bound in large volumes, this material forms the "master chart" for locating the roads. Information on highway conditions, from state and county road-department reports and from the observations of road scouts, is added to the master map. Highways are graded as first, second, or third class, and through routes are indicated.

From this, draftsmen prepare a "dummy" map by transferring a photostatic reduction of the

*The folder that you get at the filling station
is the product of patient, careful work by men
who make it their business to show you the way*

By
ROBERT E. MARTIN



5 After it has been checked and approved, the "dummy" map is placed on a glass table top illuminated from below. Here the most expert of draftsmen trace a copy of it on thin, transparent drawing paper. This tracing is the final copy of the map that will be sent to the printer

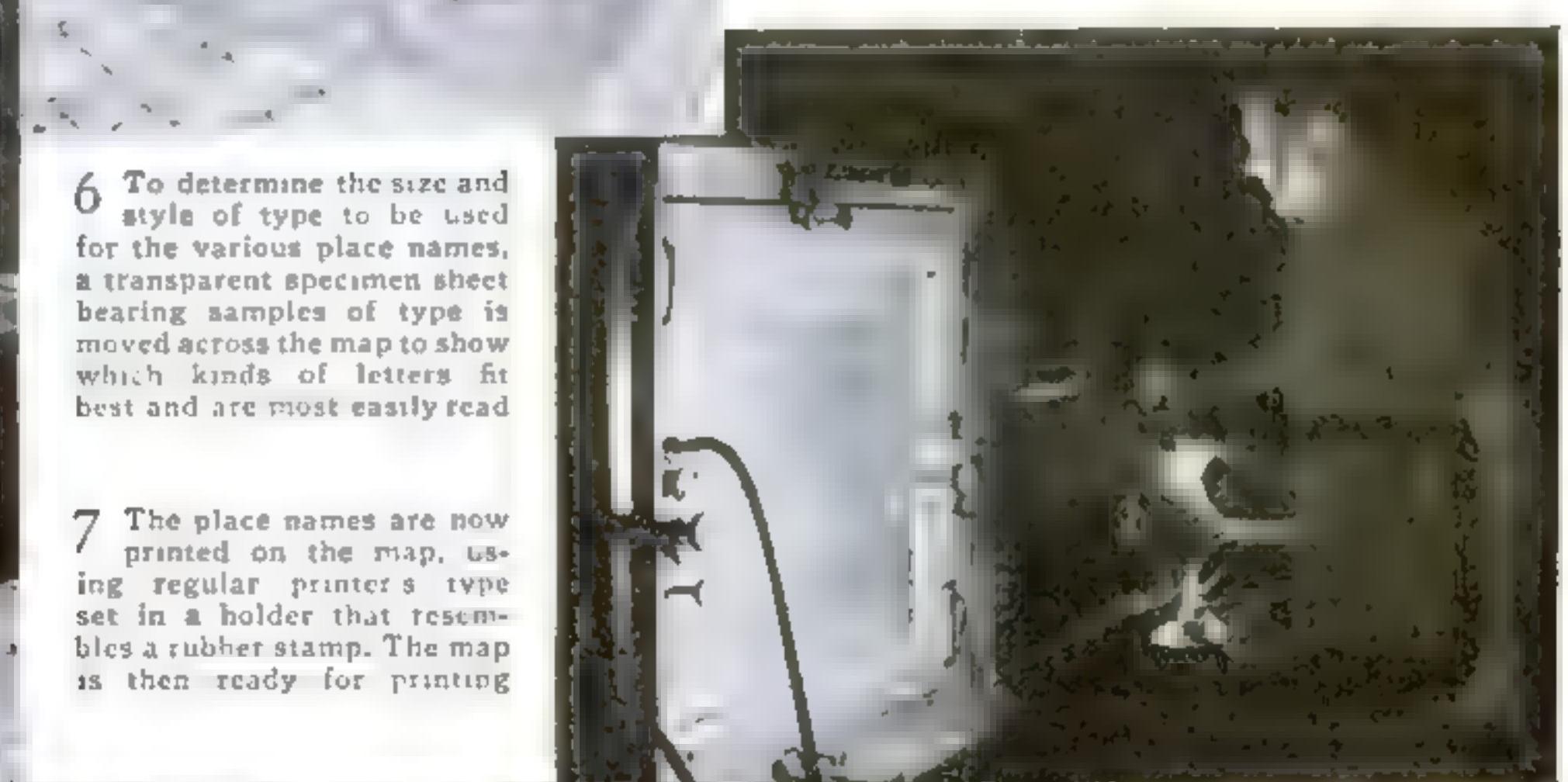


large-scale master map to tracing cloth, omitting roads that end in cow paths, and other details that would only clutter up the finished product.

When the "dummy" has been checked and approved, an expert tracer makes the final copy for the printer. Working on a glass-topped table, illuminated from below, he carefully inks in highways, rivers, boundaries, and important landmarks. Another map maker stamps on the route numbers, mileage figures, and the names of cities and towns with printer's type set in a holder that he uses like a rubber stamp.

From the drafting room, the completed copy goes to the printing plant. To retain the fineness of their delicate lines, road maps are printed by offset lithography. As the maps come from the presses, giant folding machines apply the finishing touch.

The finished map reaches your hands neatly folded in accordion pleats—a complete, accurate, up-to-date guide to help make your trip more enjoyable



6 To determine the size and style of type to be used for the various place names, a transparent specimen sheet bearing samples of type is moved across the map to show which kinds of letters fit best and are most easily read



7 The place names are now printed on the map, using regular printer's type set in a holder that resembles a rubber stamp. The map is then ready for printing



8 A dazzling arc light photographically impresses the finished map on sensitized zinc to make one of the printing plates. Here it is being done on a "step-up" machine that makes several impressions upon a single plate

9 On a huge four-color press, the finished product is run off. Foremen inspect the sheets critically to make sure that the impressions of the various colors "register," or fall in the right places. Finally, the maps are folded by big machines

ODD TESTS OF PLANE TAKE-OFFS AID IN AIRPORT DESIGN



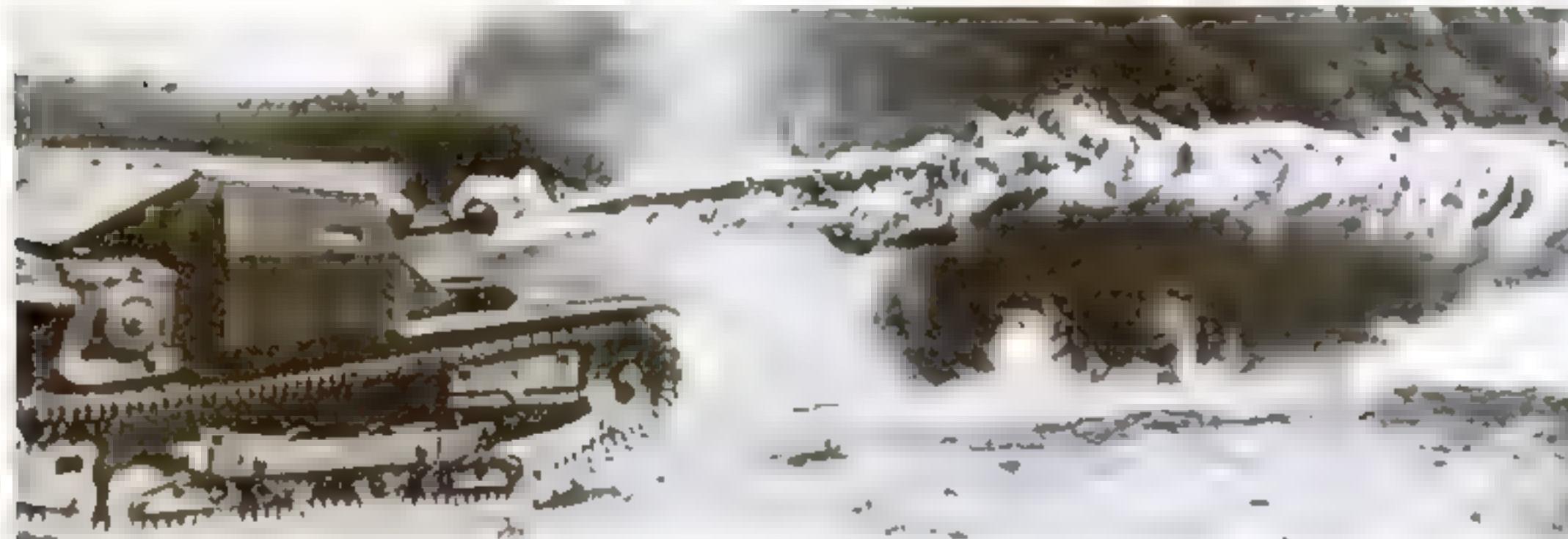
While an observer keeps a transit trained on a rising plane, a photographer snaps a record of its elevation on the instrument's vertical scale as the craft passes points on the runway

TO LEARN how long a runway modern high-speed transport planes need for leaving the ground, and the location and height of airport buildings that can be safely cleared, Government airway engineers are making an elaborate study of airplane take-offs. Timers spaced at measured intervals along the new 4,200-foot runway at a Washington, D. C., airport, report by telephone the passage of a plane as it takes to the air. A photographer, wearing headphones, responds to each signal by photographing the scale reading of a transit through which a companion observer is sighting the speeding plane. Since the angular elevation of the craft and the distance from the transit to each timer's station are known, a simple calculation gives the altitude of the plane as it

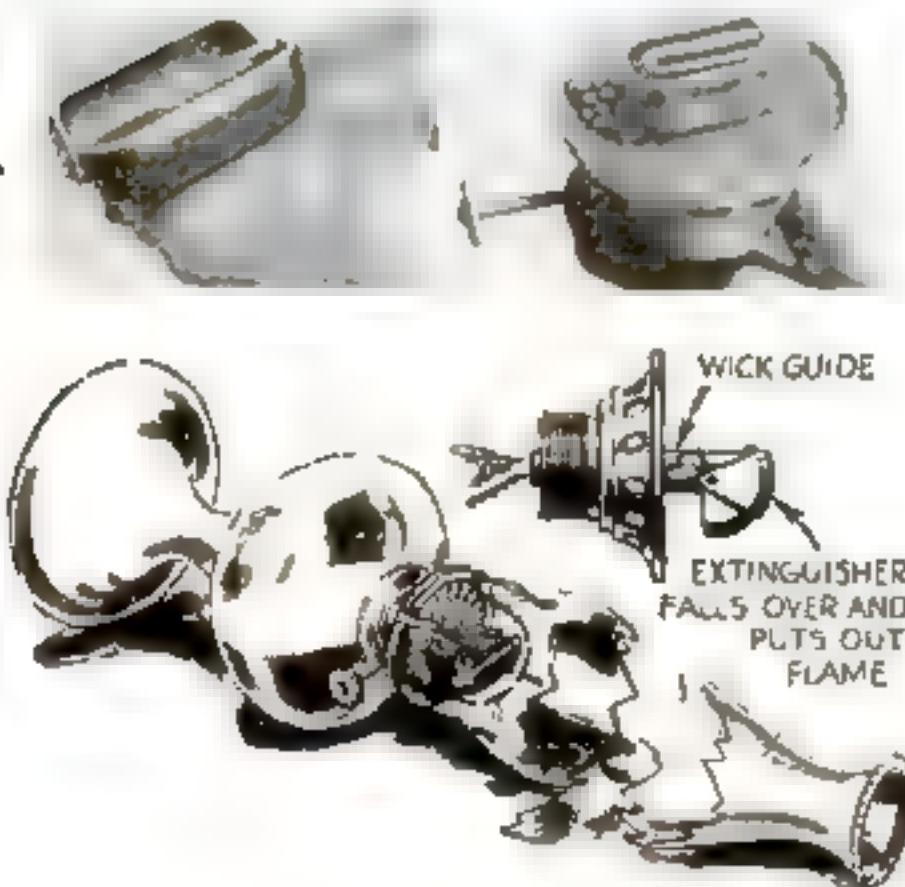
passes each timer. To complete the case history of the plane's take-off, each timer also notes the moment of its passing as recorded by means of a stop watch.



Signals from timers reach the photographer through headphones



Demonstration of a new war tank that shoots a jet of burning oil before it as it advances against an enemy



PUTS OUT UPSET LAMP

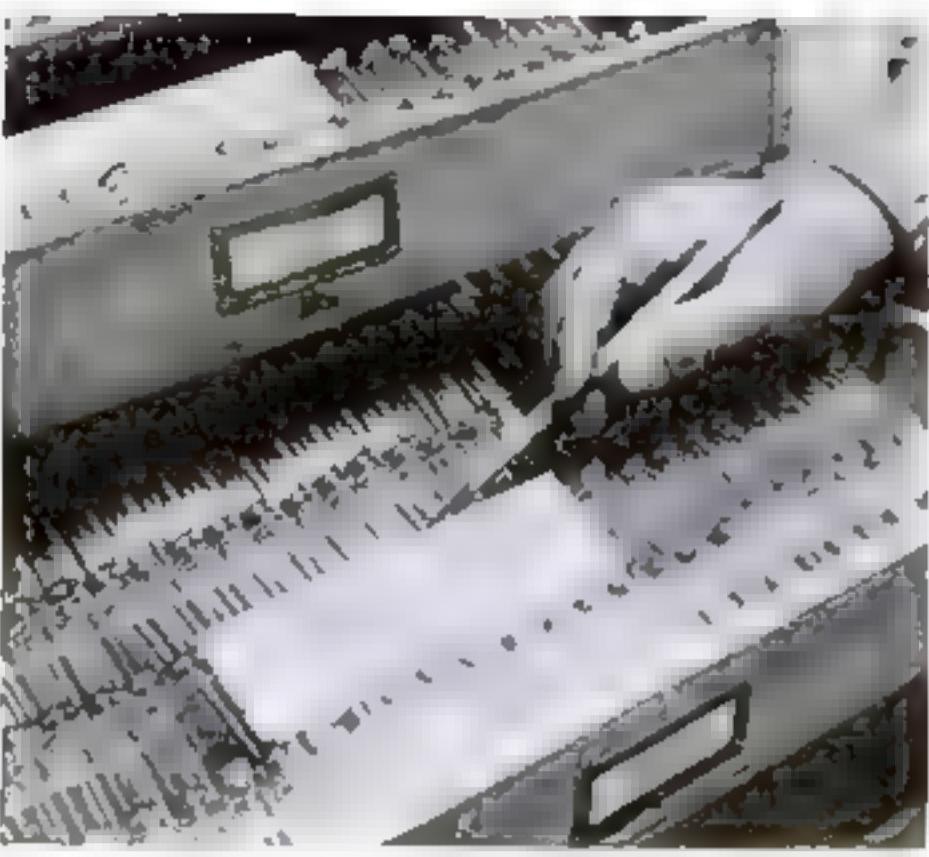
To PREVENT an upset kerosene lamp from starting a fire, a new safety attachment is snapped in place upon the wick guide with a spring clip. If the lamp tips over, pivoted snuffers automatically close over the flame and extinguish it as shown in the drawing above.

FISHERMEN DIVE FOR NAVAL SHELLS

EUROPEAN fishermen have found a profitable side line in diving for shells—the kind shot from the big guns of naval vessels during target practice. When the firing is over, the salvage vessel proceeds to the spot and men in diving suits search the sea bottom for the projectiles. As each is found, a heavy rope is made fast about it and it is hoisted to the deck. When small shells are found in large numbers, they are put into bags and lifted aboard. In shallow water the task is not overly difficult, and the valuable casings are sold back at a substantial figure to naval authorities.



A diver going down to hunt for projectiles fired by warships in target practice. Left, a large shell being hoisted aboard the salvage vessel



BOTTLED WASPS STORED FOR WAR ON PESTS

STORED in subterranean air-conditioned rooms at Moorestown, N. J., 30,000 living wasps form a reserve army ready to war against destructive plant pests. New Jersey agricultural experts keep the dormant insects in vials and "file" them according to size and class until they are needed to combat sudden outbreaks of crop-destroying beetles, moths and flies. The photo shows a tray of vials with record card.

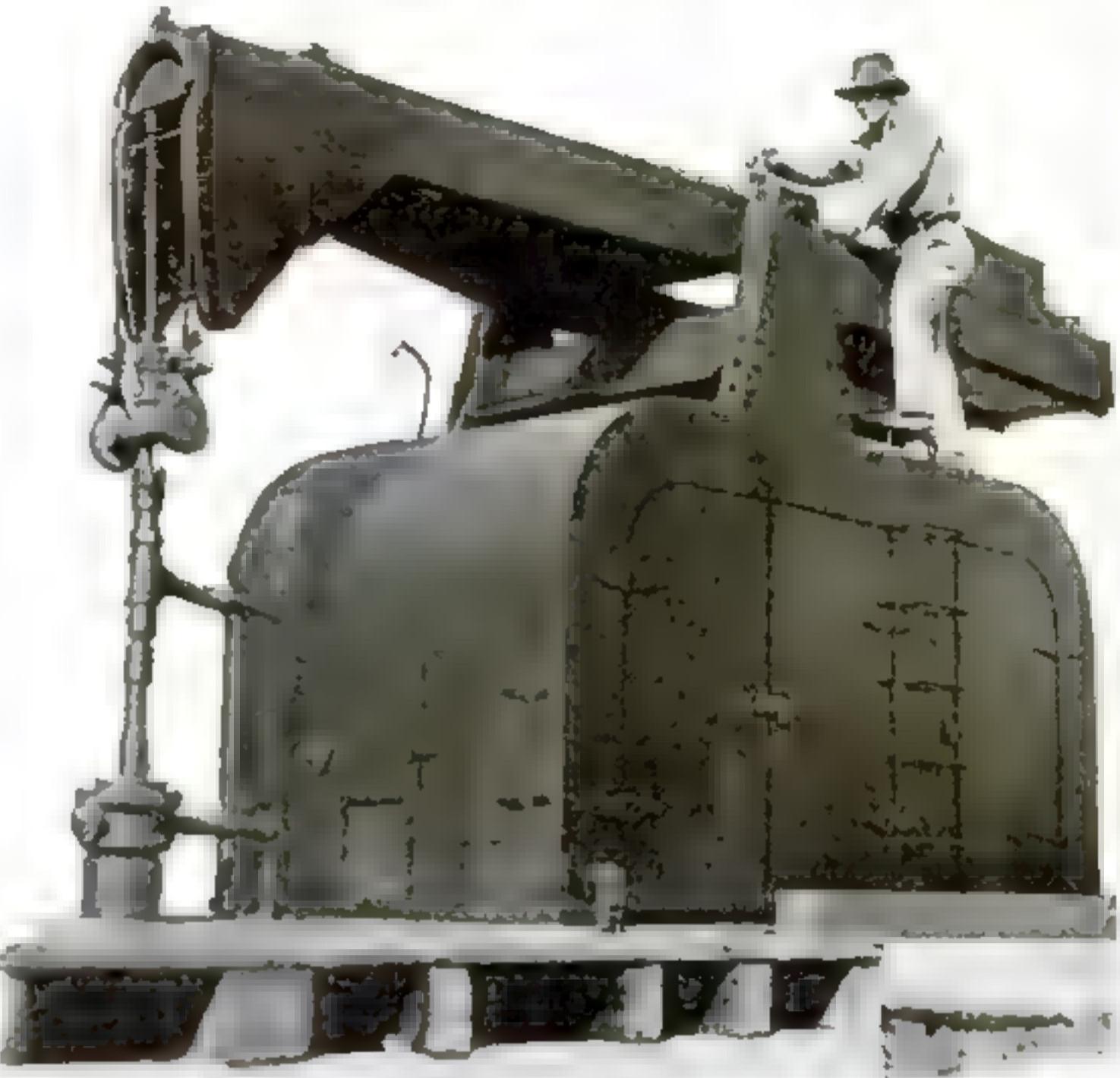
"VALISE" SHELTERS BABY DURING GAS ATTACK



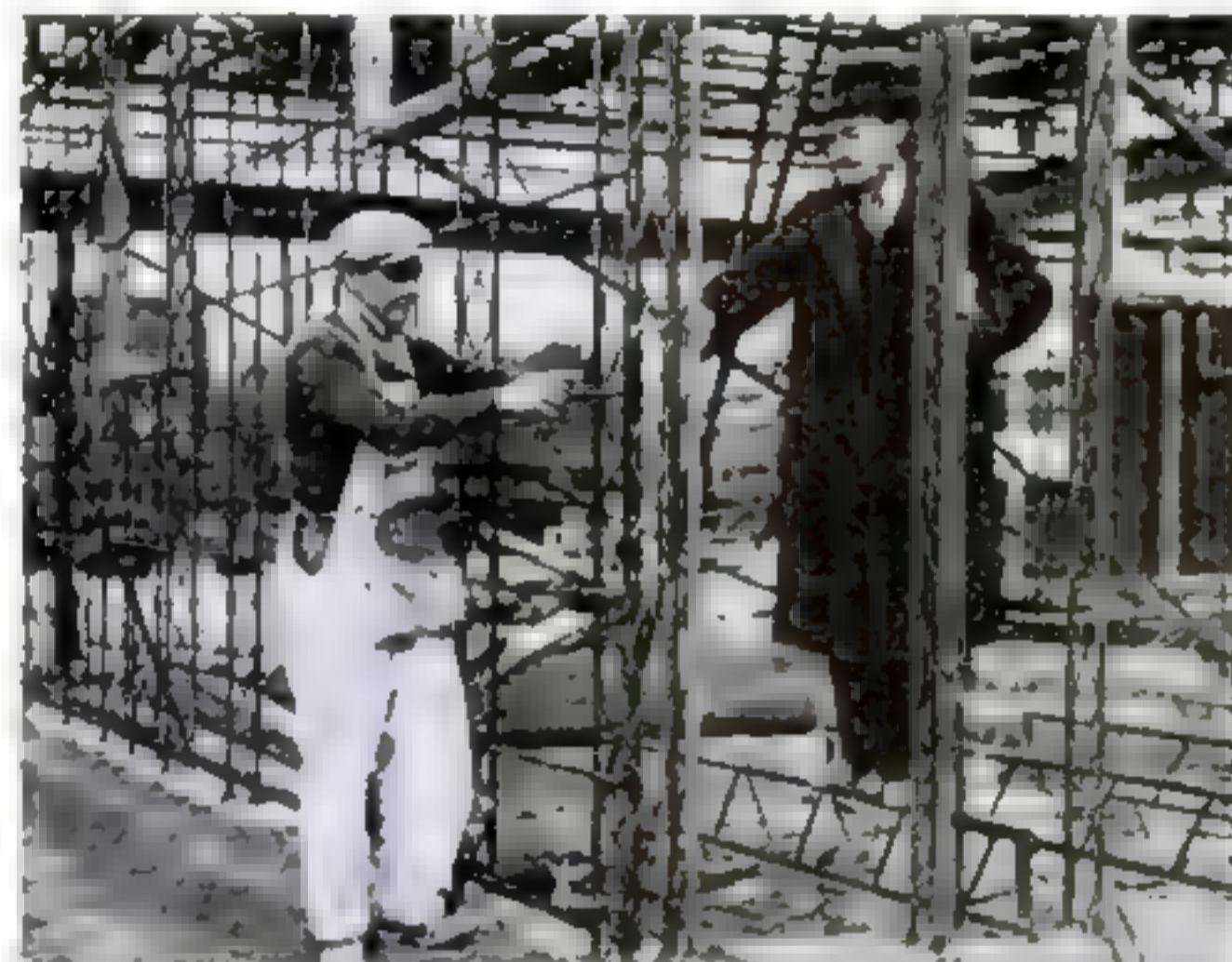
RESEMBLING a small valise, a unique gasproof chamber is designed to protect an infant during a wartime gas attack. Oxygen is fed into the air-tight bag from a tank at the side, and the baby can be observed through a window in the top without exposing it to the toxic fumes.

ELECTRIC PUMPS REPLACE OIL DERRICKS

UNSIGHTLY derrick pumps, sprawling over many of the rich oil fields within the city of Los Angeles, Calif., will soon be replaced by compact, electrically operated pumping units. Erected over the mouth of an oil well and driven by a powerful electric motor, the new pump is said to perform as efficiently as the conventional derrick type, and to be much more quiet in operation. The replacement of the familiar towers, long considered an eyesore by residents, is expected to increase real-estate values in the sections surrounding the oil fields.



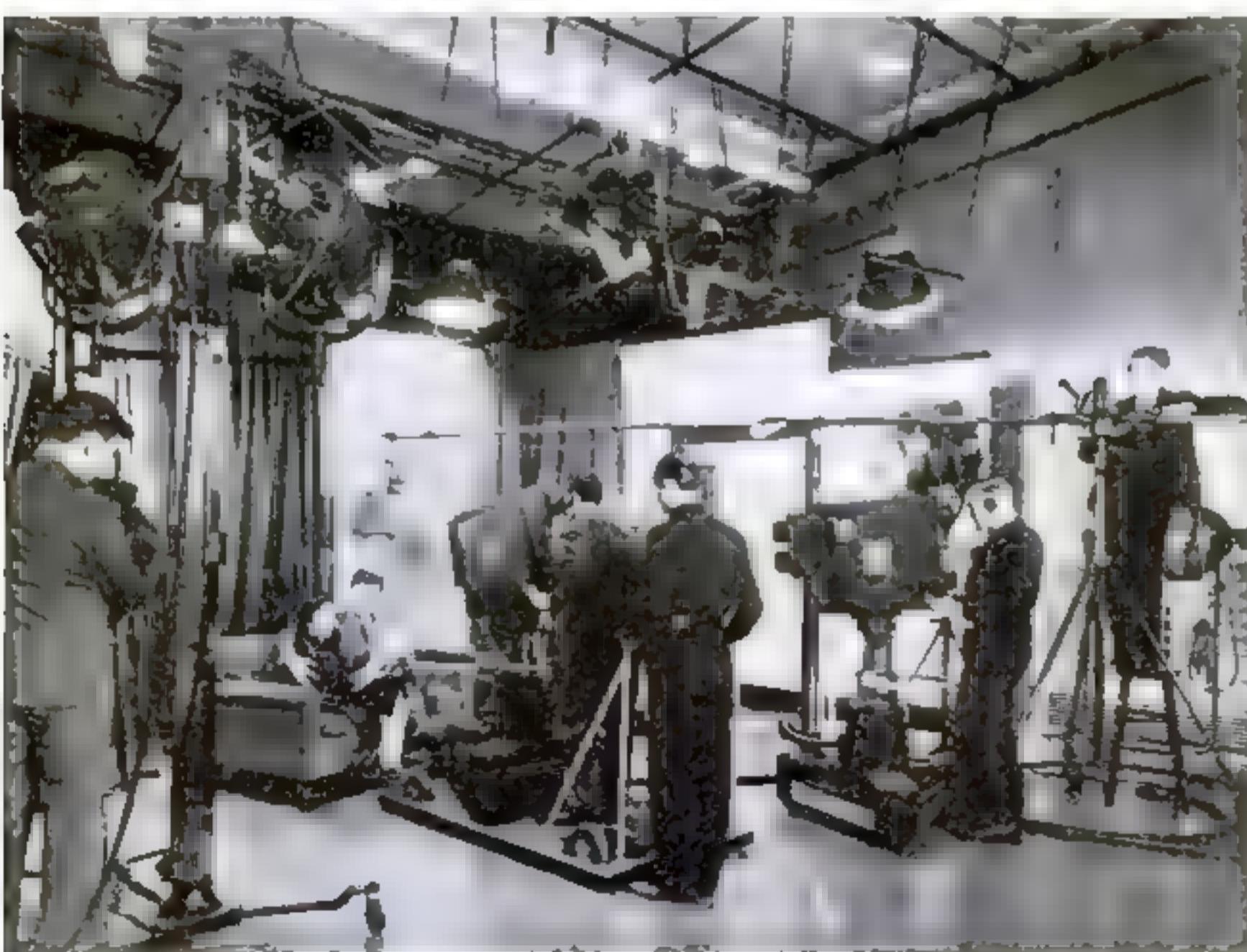
A compact, electrically operated pumping unit at a California oil well



House frame of steel strips set in concrete and welded together

STEEL LATTICE IS FRAMEWORK FOR NEW HOMES

LIGHTWEIGHT steel strips, resembling garden latticework, form the supporting frame of a new type of house now under construction. The lacy framework of steel is embedded in a concrete foundation and locked together by welding to form a strong, "one-piece" supporting structure. Builders claim that the welded steel frame will prevent the shrinking and cracking of plaster often experienced with wood.



Television programs are broadcast from this ultramodern studio in Radio City, New York

STUDIO OPENED FOR TELEVISION

TELEVISION CAMERAS on rubber-tired carriages, and microphones hung from overhead booms to keep them out of sight, lend a Hollywood atmosphere to an ultramodern television studio recently placed in service in New York's Radio City. A ten-kilowatt, six-meter transmitter atop the Empire State Building puts the images on the air. Two hundred persons recently enjoyed the city's first complete television program of speeches, news films, and entertainment originating in the new studio.

TEN FINGER NAILS POLISHED AT ONCE

FINGER NAILS are quickly polished with a new device just marketed. When the fingers grasp rotating knobs in the two parts of the unit, and it is whirled around as shown at the right, the buffer linings of the accessory polish all the nails simultaneously.



GAS MASKS PERMIT USERS TO TALK



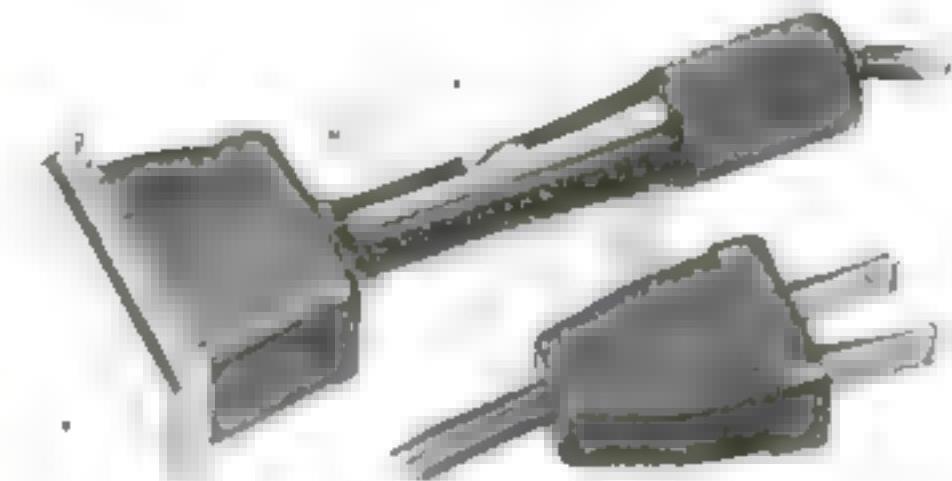
A "talking" gas mask. The voice is transmitted by a diaphragm on the chemical canister. Right, a French type of mask that even lets the wearer use the phone

WEARING a gas mask need not repress a talkative person, as inventors in this country and abroad are demonstrating. One of the latest types of "talking masks," designed by a Pittsburgh, Pa., inventor, directs the speaker's voice from an aperture in the chemical canister. Another model, of French invention, even permits the wearer to carry on a telephone conversation. In both, flexible diaphragms make the user's words audible without admitting fumes.



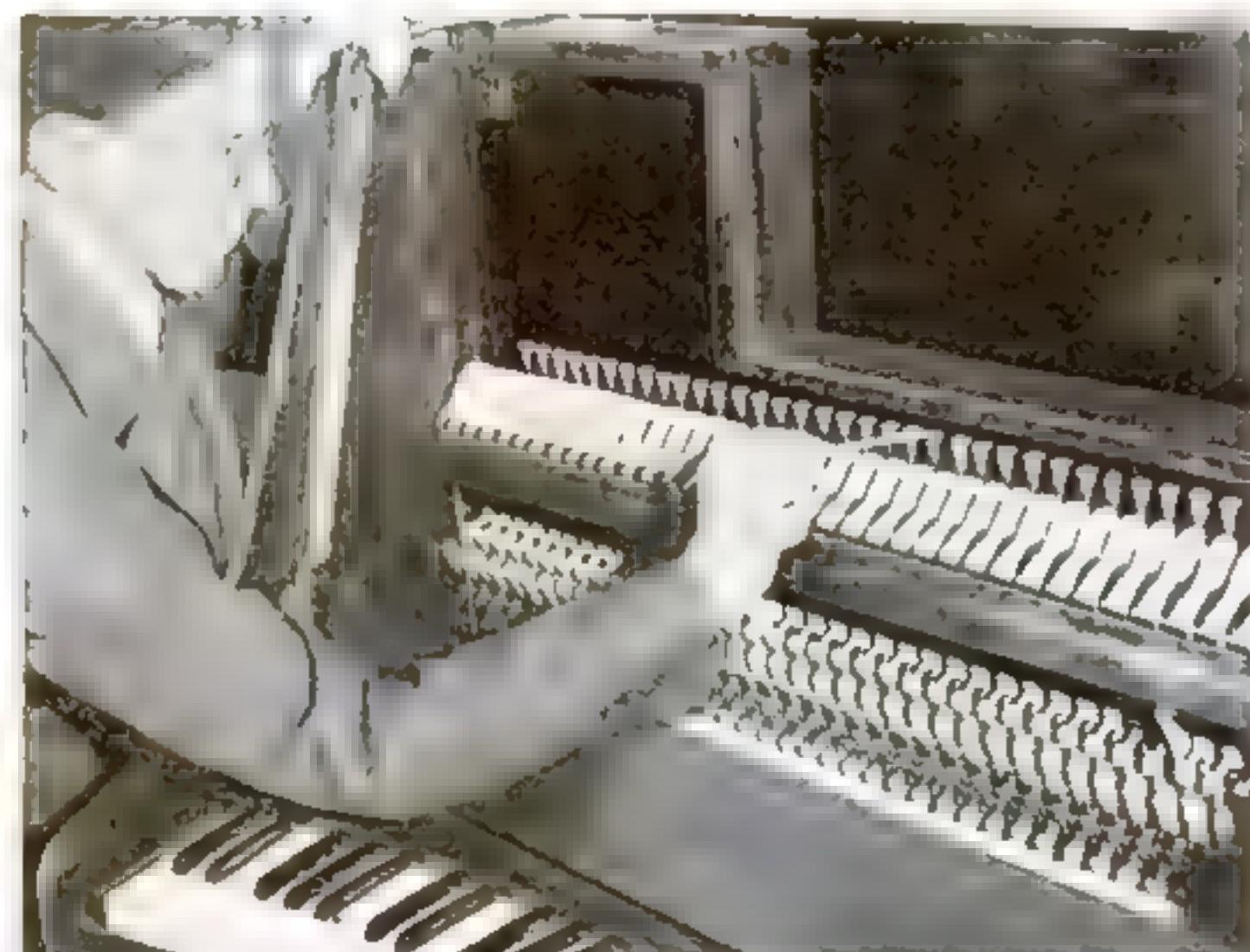
FLASH LIGHT SHOWS UP INSIDES OF DRUMS

INTERIORS of drums and barrels are easily examined by inserting the long, slender stem of the special flash light shown above. Its bulb is shielded against possible breakage, and its switch inclosed in an air-tight housing, to avoid risk of igniting any explosive vapors the drum may contain.



NEW ELECTRIC RAZOR USES REGULAR BLADES

EMPLOYING lather and standard makes of blades, a new electric razor slices off hairs by vibrating the cutting edge lengthwise as it is drawn lightly across the face. A smoother and speedier shave results, it is said, and even blades discarded as too dull for ordinary shaving may be used. Where electricity is not available, the device is used like an ordinary safety razor.



Sounding hammers strike tubes of graduated lengths to produce tones

SWEDISH RAILWAY HAS MOBILE POWER PLANTS

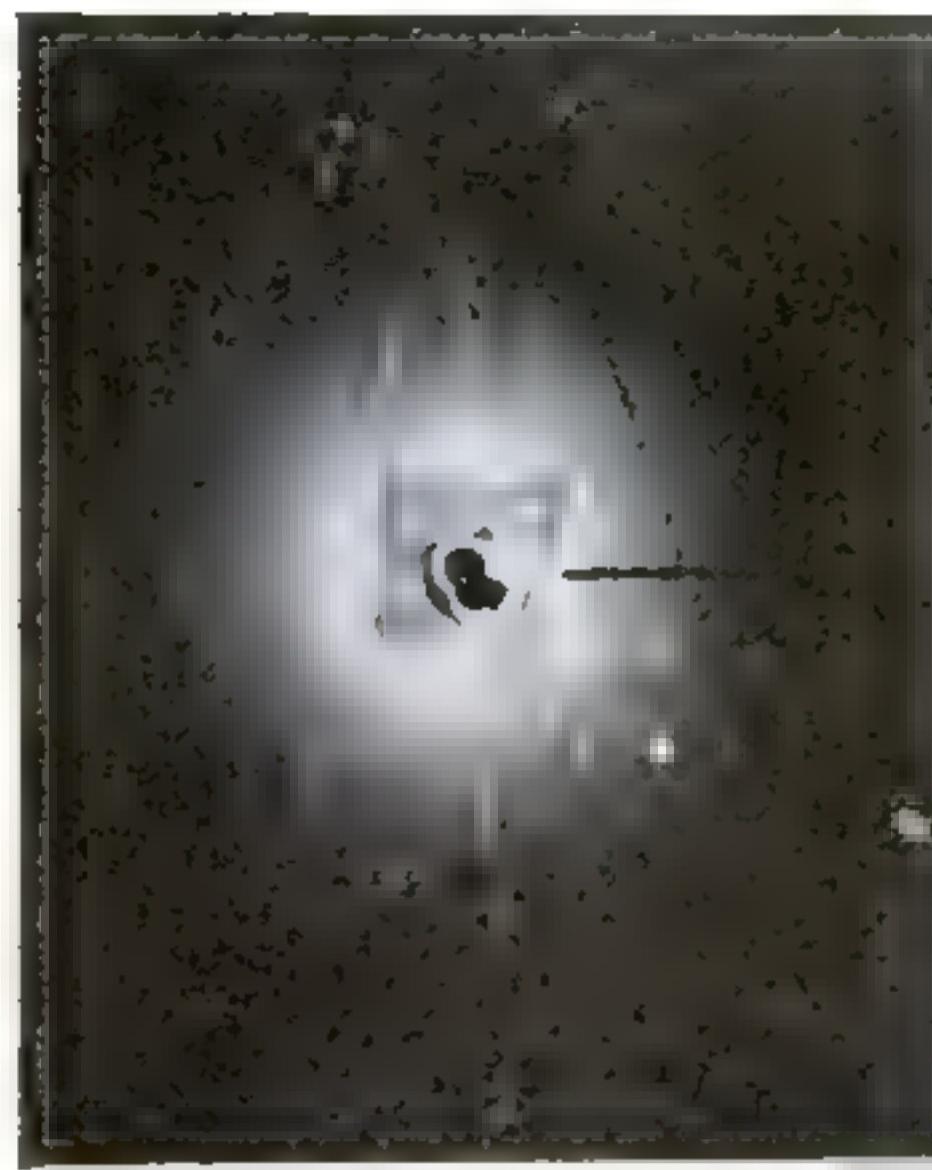
TWENTY-TWO power plants on wheels are helping to run the fast electric trains of the Swedish State Railways. Heretofore, electricity distributed from central hydroelectric stations has been converted to the proper voltage for electric locomotives at fixed substations of conventional type. These now are being replaced by traveling substations mounted on railway cars, which can be shifted from place to place to meet changing demands for current, and hauled right to the builders' shops when repairs are needed. Each unit includes a motor-generator set and transformer that deliver current at the required voltage.



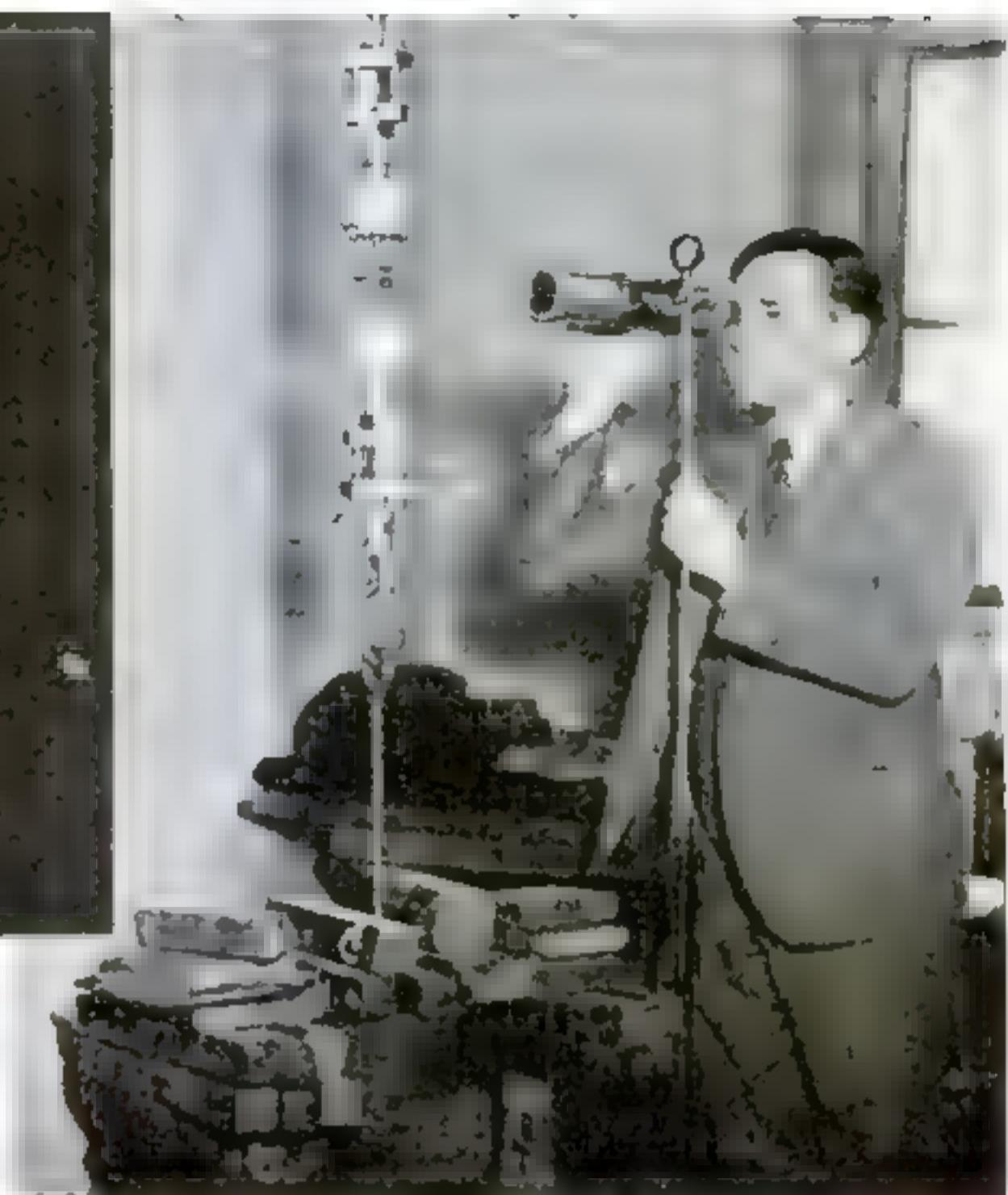
One of the traveling substations used by the Swedish State Railways to "step down" current for trains

Giant Crystals Reveal Secrets of Iron

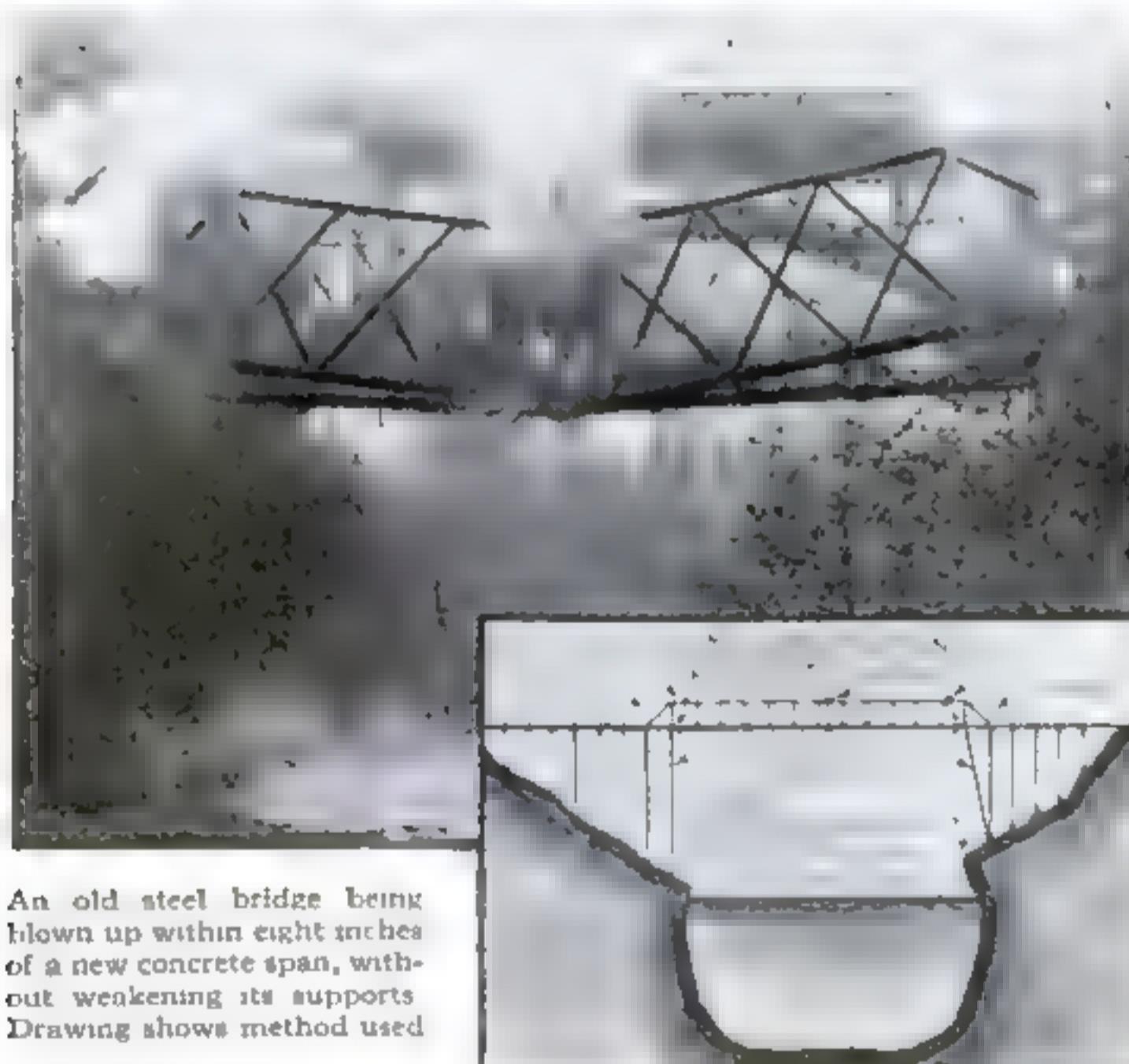
USING giant crystals more than ninety-nine percent pure, Carnegie Institute of Technology experimenters are learning new facts about iron. Even slight traces of carbon alter its behavior, so the specimens are purified by heating them in hydrogen gas. Studies of iron's fundamental properties are also complicated by its grained structure, consisting of myriads of microscopic crystals. By stretching and heat-treating a rod of pure iron, however, the research workers transform it into crystals of giant size so that they can experiment upon a single one or a group of only a few. Individual crystals may be as long as three inches and occupy the whole diameter of the rod. In one test a weighted platform, stretching the rod like taffy, reveals how the metal creeps or "flows" under continued tension. Disks sliced from the big crystals are also rolled flat, showing what happens to ordinary iron and steel in a commercial rolling mill. Alterations produced in the crystals are detected with X-ray "diffraction" photographs.



An X-ray "diffraction" photograph of a crystal of almost-pure iron, made to show its pattern of molecules.



BLASTING BRIDGE IS DELICATE JOB



An old steel bridge being blown up within eight inches of a new concrete span, without weakening its supports. Drawing shows method used.

EXPLODING thirty charges of dynamite simultaneously, engineers recently blasted to pieces an outmoded truss bridge near Estacada, Ore., without damaging a new \$80,000 concrete arch bridge only eight inches away. The chance that the falling wood and metal might cave in a rock footing, artificially reenforced to support the new bridge, made their task still more difficult. Dynamite was placed so as to break the bridge in the center and shear it at the ends, and the structure collapsed harmlessly.



Tooth-paste tube with new-type cap in use. When the cap is slid forward, it cuts off paste as shown at left.

NEW TOOTH-PASTE CAP SLIDES ON AND OFF

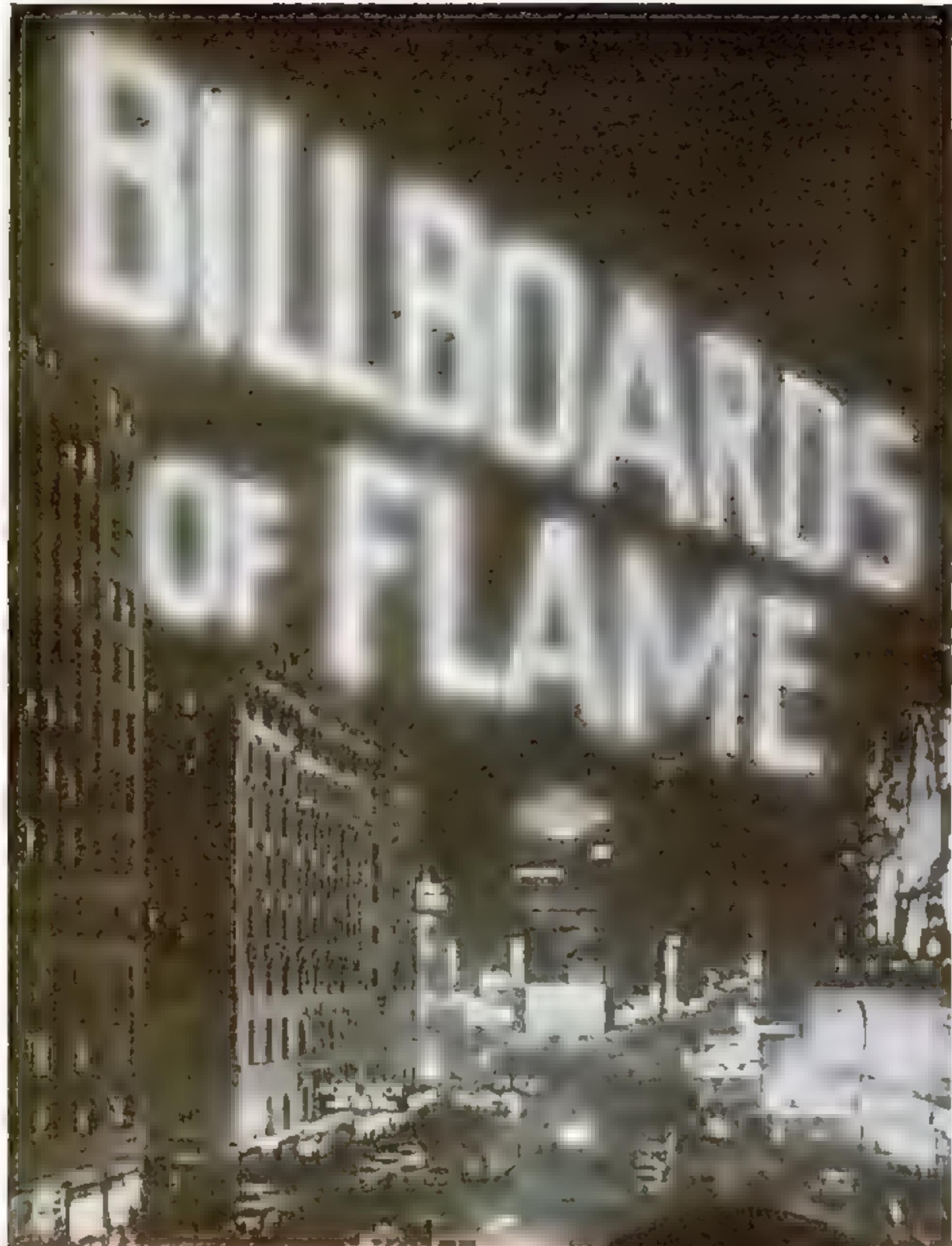
QUICK-ACTING and impossible to lose, an ingenious new cap designed to replace the screw caps of tooth-paste and shaving-cream tubes is permanently attached by a wire loop. To open the tube, it is simply drawn aside. Sliding it back into position shears off the desired amount of paste and seals the tube.

COTTON PICKER COMBINES MACHINE AND HAND WORK

A SEMI-AUTOMATIC cotton picker recently demonstrated at Memphis, Tenn., is said to combine advantages of hand picking and of harvesting the crop with all-mechanical types of apparatus previously developed. Whirling claws in a hand tool seize the cotton and strip it from the plant. A suction tube then delivers the cotton to a hopper in the collecting machine. With the aid of the new device, two men can do the work of a gang of ordinary cotton pickers, and the operation, according to the inventor, is carried out without injuring the stalks or green bolls.



This cotton picker has a hand tool, shown in circle, for removing the blooms harmlessly.



Times Square, New York's Great White Way. Because larger crowds are concentrated here than anywhere else in the United States, it is the choicest location for spectacular electric signs. Part of the sensational new sign advertising chewing gum is seen at the right



A favorite among the early animated signs. The kitten was supposed to chase the spool, but once the control went awry and the spool went after the kitten

Left, one of the first big electric signs. It stood on the present site of the Flatiron Building in New York and was condemned by many people as being much too audacious



DURING recent days, special trucks have been rolling into Times Square, in New York City. Steel workers have been swarming over the roof of a Broadway building. Laborers have been hoisting sections of a gigantic steel sign to a framework 100 feet above the streets. Each night, in glowing tubes and flashing lights, this display will show peanuts a yard long pouring from a bag as big as a forty-two-passenger bus. It is the latest eye-catcher in the electric galaxy of Broadway.

Two blocks away, another newcomer, said to be the largest display of the kind on earth, stretches for a block and towers higher than the Statue of Liberty. This million-dollar, 110-ton giant began its Broadway "run" only a few weeks ago. Advertising chewing gum, it burns as much electricity each night as a town of 10,000 inhabitants.

Almost twenty miles of wire, 29,508 bulbs, and more than 1,000 feet of neon tubing produce the rippling sea and the immense brilliant-hued tropical fish that swim across it in this dazzling display. A roof-top house the size of a three-room apartment holds the automatic mechanisms which keep the great sign running from dusk until one o'clock in the morning.

Around the world, people have heard about the Great White Way which stretches through the heart of America's largest city. At night, its neon tubes cast on the sky a pinkish glow that can be seen from three states: New Jersey, New York, and Connecticut. Hundreds of miles of wire, tens of thousands of varicolored lights, miles and miles of neon tubing produce this extravaganza of light. On one sign, a penguin winks its electric eye 33,000 times a night; on another, a sixteen-foot acrobat, outlined in neon tubing, swings across a half-block-long sign; on still a third, a great wheel of light, with approximately 2,500 glittering lamps, spins at a circumference speed of sixty-three miles an hour.

In other cities from coast to coast, similar signs—known to the trade as "spectaculars" or "specs"—are a dazzling feature of the night landscape. One national concern buys more than a quarter of a million bulbs a year to replace burned-out lamps. A vast industry keeps the spectaculars going. These companies lease the site; design, build, erect, and operate the display; and charge the advertiser rent which runs from \$2,000 to \$10,000 a month. The hugest signs rent for as much as \$200,000 a year. Contracts are signed for from one to ten years.

During that time, if a new building rises and cuts off part of the view, the advertiser is automatically released from his contract. In one instance, a competitor leased a low roof top and erected a 100-foot wall to kill a sign on the building behind.

Occasionally, the owner of a building will receive more from renting sign space than he will from renting the building itself. Such is the case with the Astor Theater, in Times Square. You can rent the whole interior for less than you would have to pay for the sign spaces in front. The revenue from sign space on Times Square buildings runs to nearly \$400,000 a year.

Long before a spectacular begins flashing its nightly message to the world, a corps of skilled men, ranging from artists

to tinsmiths, and from electricians to cameramen, have played their part. For every sign is an individual problem.

While the latest addition to the Broadway galaxy, the sign with the giant peanuts, was under construction, I spent an afternoon at the New York plant of the General Outdoor Advertising Company where it was being assembled. Before the first sketch was made, I was told, the engineers had to answer the question: How do peanuts pour from a bag? Do they roll, slide, or tumble?

To find out, they turned to slow-motion pictures. A cameraman shot hundreds of feet of film recording how peanuts pour from a bag. Run slowly through the projector, these pictures revealed that the nuts do not really roll and tumble as they appear to do. They slide out, jostling up and down as they come.

Using the successive frames of the movie strip as a guide, the experts plotted out the different steps that would show the motion of the peanuts on the electric sign. The use of slow-motion pictures as an aid to getting the correct movement of objects when building spectaculars is rapidly becoming standard practice with outdoor-advertising companies.

Oftentimes, it requires three months or more to design and erect a new display. Planning the intricate wiring may take a week. Special automatic machinery must be designed, in many cases. Immense sheets of paper, ruled off in squares, are laid down on a wooden surface resembling a dancing floor. On these sheets, artists sketch the complete sign, full size. Using this as a guide, tinsmiths, painters, electricians, and steel workers set to work and build the great display.

Realistic movement is imparted to the big electric signs by outlining the successive steps in the action in incandescent bulbs or neon tubes. Each group of lights is wired in a separate circuit, and the different circuits are "cut in" at the proper times by a motor-driven mechanism in which cams on a revolving shaft open and close the switches at the correct intervals. The effect is like that produced by the animated cartoons you see at your movie theater.

Today, when a big spectacular is switched on for the first time, newspapers report the event as they would the opening of a new show. In 1900, however, when one of the first notable displays of this kind appeared on the site of the Flatiron Building, at Twenty-third Street and Fifth Avenue, there was a dubious shaking of heads. One writer of the day referred to it as "the most offensive advertisement that challenges our brickbats"! This display showed a thirty-foot pickle, in bright green, on an orange background. Around it were scores of dancing lights.

In the years that followed, a long succession of spectaculars became a feature of Broadway. The one that is remembered best of all was an advertisement for a silk manufacturer, showing a kitten playing with a spool of thread. One night, something went wrong with the mechanism and the sign started running backward. Spectators thronging the streets below saw the tables turned, with the thread chasing the kitten instead of the kitten chasing the thread.

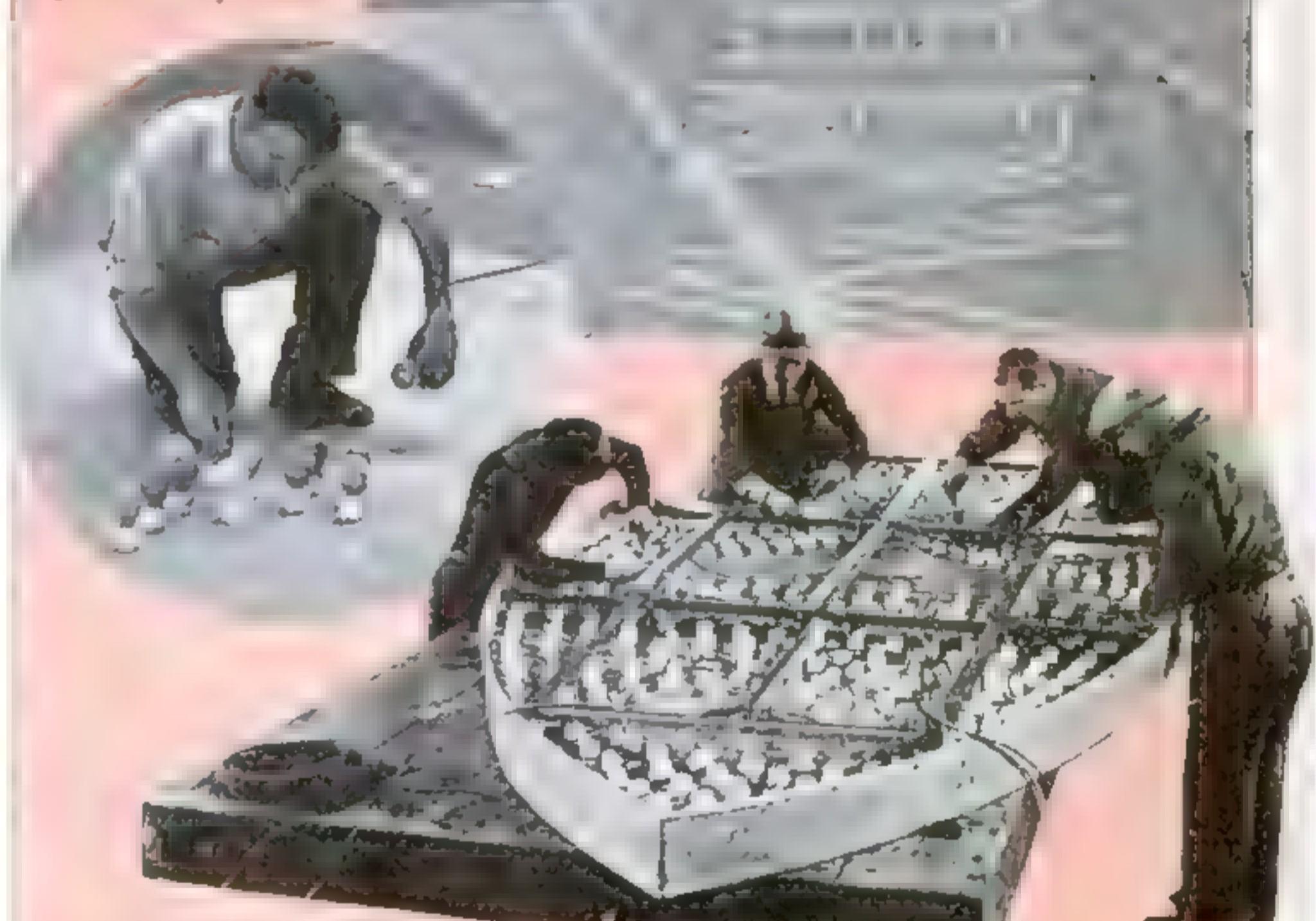
Three other celebrated signs in the history of spec- (*Continued on page 108*)

EDWIN TEALE tells you something about the spectacular electric signs that create new magic in the night skies of our cities

Right, laying out a giant electrical display. On huge sheets of paper, the artists sketch the complete sign full size. This serves as a guide in the successive steps



Below, a workman is placing the sockets for bulbs. The position of each light is indicated, and its color is specified



Wiring a unit to be used in a big "spectacular." Hundreds of miles of wire go into a single display



A typical sign shop. The figure of a fish seen in the background is the unit being wired in the view above. It now swims in an ocean of light on one of Broadway's spectacular signs

Riding Herd on

Fur seals sunning themselves on a rock in the Pribilof Islands, breeding ground of the famous Bering Sea herds which are protected by the U. S. Government. Below, a mother seal and her young



To the U. S. Coast Guard Goes the Strange Job Of Providing an Escort To Protect Uncle Sam's Fur-Bearing Wards on Their Annual Migration

By JOHN E. LODGE

DOWN from the Bering Sea, a glistening brown horde of more than a million seals has just poured through the channels of the Aleutian Islands, headed away from the Alaskan mainland, and disappeared in the Pacific. Every fall, they vanish in this mystery of migration. For four months, the Pacific swallows them up. Then they reappear off the coast of southern California, swarming north on the long journey home.

At this point begins one of the strangest convoy services of the sea. Coast Guard cutters, putting out from ports along the way, a few months hence, will steam up the coast with the migrating animals, guarding them on their 3,000-mile journey to the treeless, mist-enshrouded Pribilof Islands in the heart of the Bering Sea.

This unique patrol has been maintained for a quarter of a century. For the herds of the Pribilof Islands, comprising eighty percent of the fur seals of the world, are a prized possession of Uncle Sam.

How the United States acquired these wandering animals, and how the annual 3,000-mile seal patrol started, is an exciting story that goes back 150 years.

In the summer of 1786, a Russian adventurer, Gerissam Pribilof, was sailing cautiously through a lifting fog north of the curving chain of the Aleutian Islands when he heard a far-away, thrilling clamor—the mingled voices of 2,000,000 seals roaring, barking, bawling, whistling at the same time. Working closer to the uproar, Pribilof found the black, volcanic rocks of several hitherto unknown islands literally alive with seals. He had stumbled upon a gold mine of furs, the legendary breeding ground of the Bering Sea herds.

The five islands he found are volcanic peaks rising above the water 240 miles from the nearest point of land. Three are unimportant. Two, St. Paul and St. George, hold the rookeries of the seals. The combined area of the islands is less than seventy square miles. Without trees

or shrubs or running streams, these dots of land are among the strangest islands known. During summer, they are covered with tinted moss, purple lupines, and Iceland poppies. And, for nine days out of ten, fog fills the air.

It is this fog that makes the spot ideal for the seals. They cannot stand much brilliant sunshine while on land, and the clouds of mist that shroud the Pribilos make their summer home a sort of semi-ocean in which they live in comfort.

This fog also played a part in the raids, battles, and bloodshed that have marked the history of the islands. When the Pribilos came into the possession of the United States, at the time of the purchase of Alaska from Russia in 1867, the seals had been slaughtered by the hundreds of thousands. During the next forty years, while the Government leased the sealing rights to private concerns, the slaughter continued unchecked.

Under cover of mist, poaching parties of British, Japanese, and American seal hunters would land on the islands and leave the beaches strewn with the bodies of dead seals. Lookouts kept a constant watch; armed guards patrolled the beaches; but the raids continued. During one summer, sixty ships, flying the flags of half a dozen nations, were circling the islands, waiting for a chance to land.

Once, on a single fog-filled night, four raiding parties landed on different beaches at the same time. The muffled roar of their sawed-off shotguns seemed to come from all sides at once. Another time, a pitched gun battle between native guards and Japanese raiders left three of the poachers dead and seven captives.

During the last days of the nineteenth century, Alexander McClain—said to have been the original of Jack London's "The Sea Wolf"—and others of his kind were writing lawless chapters into the saga of the seal islands. By 1911, the great herds that Pribilof had seen had been reduced

a Million SEALS

to fewer than 250,000 seals. Poachers were following the migrating animals, killing them at sea; they were waiting off the Pribilofs for mother seals to come out to feed; for the hundreds that were hauled into the boats, they were killing thousands that sank and could not be recovered. Ruthless slaughter was rapidly speeding the seal, on the trail of the great sea otter, to extinction.

Then, in 1911, the seal herds of the Bering Sea were given a new lease on life. Japan, Russia, Great Britain, and the United States signed a treaty outlawing the killing of the animals at sea as well as on the islands. With Coast Guard ships circling the Pribilofs during the breeding season, and guarding the herds on their long migrations, illegal sealing has virtually ceased.

As a result, the herds have increased until today they number more 1,500,000. A decade or so hence, they may reach the peak figure of 2,000,000 once more. Already, the fur from this strange cluster of islands has brought Uncle Sam nearly ten times the whole purchase price of Alaska!

Only experts designated by the Government now kill the seals. Last year 57,000

Coast Guard cutters like this convoy the seals as they return to the breeding grounds from their mysterious migration far off in the Pacific



pelts were shipped south for sale. To understand the scientific methods employed in the annual "seal census" which determines how many animals can be killed without endangering the herds, it will be necessary to take a look at the astonishing, almost fantastic events that take place each summer on these misty isles.

Along in May, the bull seals arrive. They are great, hulking brutes that may attain a weight of 600 pounds. Five times

as heavy as the females, they have deadly teeth as sharp as sabers. Eskimos call them "the bears of the sea." Year after year, the bulls hoist themselves onto the identical rocks they occupied the year before. There they wait, looking out to sea, for the return of the females.

Oftentimes, more than a month goes by before the surf around the islands is filled with the bobbing heads of the homecoming wives. They, with the younger seals, had migrated *(Continued on page 112)*



Every year, this amazing scene is reenacted on the barren shores of the Pribilofs, as the precious fur-bearing animals gather for the breeding season. Each bull seal has a particular spot on the beach to which he returns every spring, and here he collects as large a harem of cows as he can capture

By
RUDY DUSEK

This toe-and-chin hold will keep a ruffian quiet until help can reach you. Bend his knees and press his feet down behind him with your thighs, while grasping his chin with both hands and pulling upward. If he struggles, applying a little more pressure will stop him.

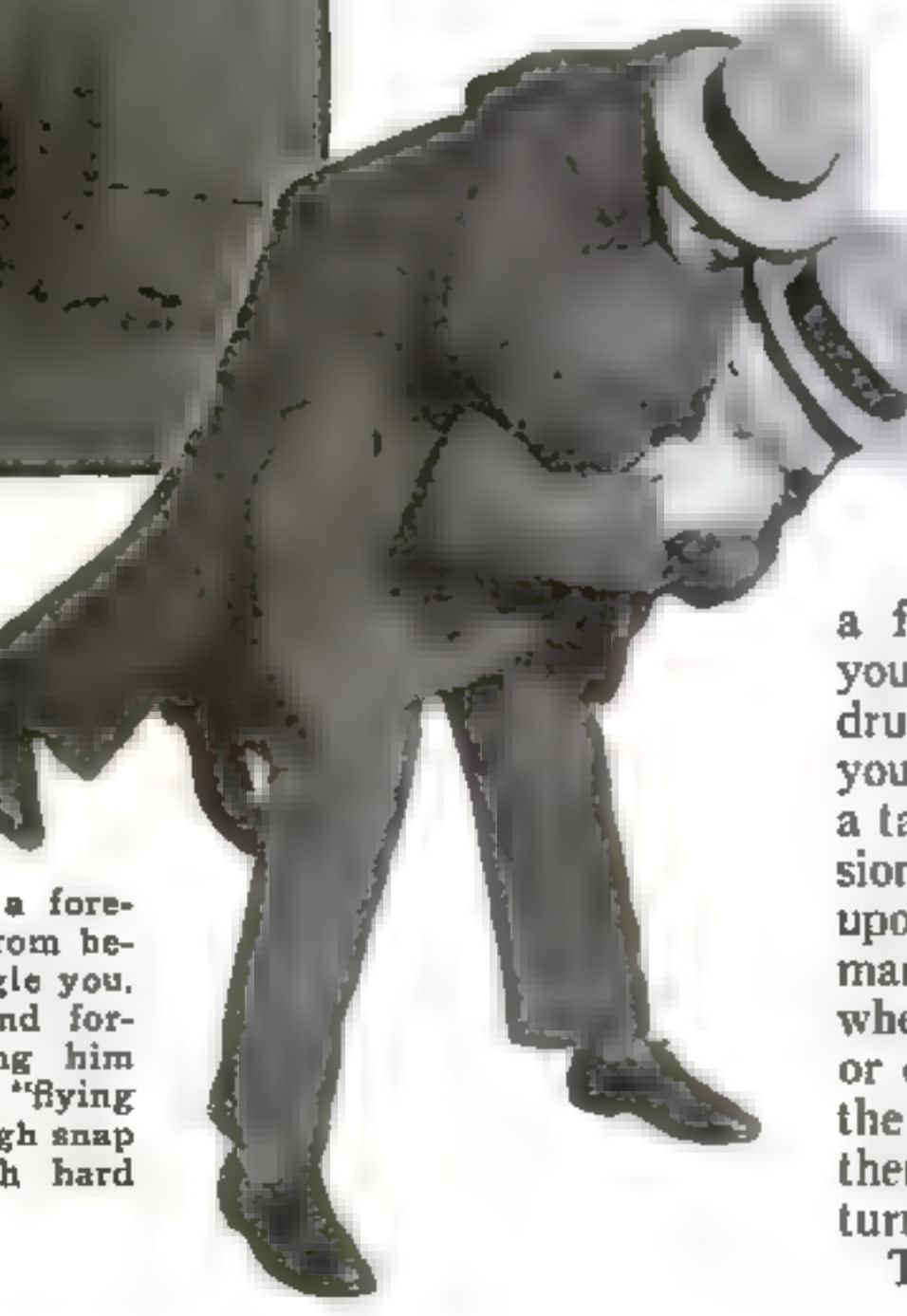


Wrestling Tricks for Self-Defense



BREAKING
A STRANGLE
HOLD WITH A
"FLYING MARE"

If an assailant hooks a forearm under your chin from behind and tries to strangle you, grab the arm and bend forward quickly, throwing him over your head in a "flying mare." If you put enough snap into it, he will crash hard.



FIGHTING may not be your business; it may, in fact, be positively distasteful to you. But in the life of every man there comes a time when he will have to protect himself, or some one who depends upon him for safety.

The good old American method, the single punch to the jaw that always floors the villain, seems to work fine in fiction and in the movies; but, you'd be surprised how ineffective it is in

actual practice. You may have seen street fights in which the combatants slugged each other until both were utterly exhausted, with nothing more decisive at the end than bloody noses and black eyes.

When a thug comes at you with a knife or blackjack, when a footpad sticks a gun in your ribs, when a crazy drunk swings at you while you are peacefully seated at a table—these are not occasions in which you are called upon to display your sportsmanship. These are times when you want to overcome or disable your attacker by the quickest means possible, then hold him until you can turn him over to the police.

These are the situations

that I will try to tell you how to meet.

When a holdup man points a gun at you and demands your money, the wisest course may be to hold your hands high, be as quiet as possible, and let him take the wealth you are carrying. However, if you consider it safe to try to disarm him, by all means make the attempt, but know how to go about it.

Here is the "Farmer Burns" method, the method of disarming that is taught policemen, who are called upon to meet such situations more frequently than you or I.

Try to distract your assailant's attention for an instant. Glance over his shoulder as if some one were coming up behind. Use any other ruse you can think of to get his eyes off you for a second.

Take a quick step to your left, if he is holding the gun in his right hand. At the same time, bring your left hand up sharply and smack the wrist aside, so the gun will no longer be pointing at you. Retain your grasp on the wrist, and twist outward. With your right hand, seize the back of his fist and bend the gun hand backward on the wrist.

The gun will now be pointing at him, instead of at you. If he pulls the trigger—why, that is just his hard luck. When the hand is bent far enough, the pain will be so intense he will loosen his hold on the gun, and you can take it away from him with your right hand.

As you keep on twisting the wrist, he will have to step forward with his right



DISARMING A MAN WITH A CLUB

Grasp your adversary's wrist with your left hand, and pass your right arm under his forearm as a fulcrum. Press backward, throw him off balance, and trip him as shown at right



Practice up on these simple holds described by a star of the arena, and you will be ready to protect yourself against thugs and bullies

foot to keep his balance. His whole weight will shift to that foot. When this occurs, kick that foot out from under him with your left foot, and retain your twisting hold on his wrist as he falls. You have the gun now. He is lying on the ground, helpless, and you are in complete command.

But you've got to be quick. You should do everything described here almost simultaneously.

If an assailant comes at you with a knife, held waist high and directed at your middle, you can disarm him by the same method used against the gunman; but, of course, you can go about it with much more confidence with no bullets to worry about.

If the knife wielder comes at you with the weapon held high, to stab downward, a properly applied wrist lock will disarm him and place him on the floor so fast he won't know what has happened.

Step into him promptly, while the arm is still raised. If he is a right-hander, grab that wrist with your left hand and keep pushing it back. At the same time, shove your right forearm under his upper arm and grab either his wrist or your own. Pull downward on his arm, with your own right forearm acting as a fulcrum.

Keep crowding him hard as you bear down. He will be thrown off balance, and will drop the knife as he falls backward. By sitting on his shoulder after he is down, and retaining the hold, you can keep him powerless as long as necessary, for your whole weight and strength will be pitted against his one arm, which will be twisted painfully out of position and held by powerful leverage.

Jimmy Londos called this the Japanese arm lock. It was one of his favorite holds.

"AIRPLANE SPIN"

To stun a larger assailant, lift him like this, spin around, and crash him down on his head

It can be used against a bottle or club wielder equally as well. In fact, you can snap it on any-time you can push an assailant's hand back of his shoulder. The trick is to get the hand back, and the leverage started, before he can exert his strength against you. An easy hold to break if caught in time, it is hopeless when once properly applied.

If an assailant hooks a forearm under your chin from behind and attempts to strangle you, grab the arm and bend forward quickly, throwing him over your head in a "flying mare." If you put enough snap into it, you can crash him on his head or back with such force that it will be easy to handle him afterward, though perhaps a stretcher may be necessary.

This is a handy hold to know. Even if your adversary isn't so obliging as to place himself in position, a little quick maneuvering on your part will frequently turn the trick. If he is facing you, grasp his wrist in both hands and (*Continued on page 116*)

HOW TO BREAK A BODY HOLD

When some one circles your body from behind, relax your chest muscles and work his arms up under your armpits. Then drive your elbows backward and expand your chest to the limit



WATCH THAT KNIFE!

Below is shown a way to take a knife away from a thug. The hand holding the weapon is held palm upward and is bent back, with your own left arm serving as a fulcrum for applying strong pressure

LIGHTS DIMMED FOR MOCK AIR RAID



A street lamp and, at right, a motorcycle headlight being shrouded for a test of air defenses of Paris, France

DURING recent antiaircraft preparations against a mock night air raid on Paris, French military officials adopted novel methods to hide the city from "enemy" planes. Street lamps were shrouded with odd mushroom-shaped dimmers to mask the location of boulevards and avenues, while blue filters made of gelatine subdued the headlight beams of official autos and motor cycles.



BILL-TESTING DEVICE SPOTS PHONY MONEY

TO HELP cashiers to spot counterfeit money, a new bill-examining device has recently been introduced. Bills inserted in a slot at the side are illuminated by a powerful lamp and easily examined for telltale defects with the aid of a built-in magnifying lens. The unit is also adapted to scrutinizing bank checks for evidences of alteration, raising, or forgery. The photograph above shows a bill being examined.

SPEEDBOAT HAS AUXILIARY AIR RUDDER



New Italian-designed speedboat in action, showing airplane-type rudder for high-speed turns

FOR STEERING at high speeds, an airplane-type rudder supplements the conventional underwater rudder of a new speedboat of Italian design. Recently test-

ed in Florida waters, the whale-shaped speedster is said to be capable of a speed of 130 miles an hour. The craft is powered by twin twelve-cylinder engines.

HUGE WOODEN BALL PLUGS WATER PIPE

ENGINEERS recently adopted a novel method of blocking the flow of water prior to cleaning the penstock tubes that penetrate the underwater part of the Shoshone Dam in Wyoming. A ball-shaped wooden plug, filled with concrete and covered with felt and canvas, was lowered from a

cableway to a position just in front of one of the tube openings. The force of the water rushing into the pipe jammed the 8,600 pound ball into the opening and effectively stopped the flow, enabling workmen to enter through manholes and clean out the tube.

This 5½-foot ball was used to plug tubes from a dam

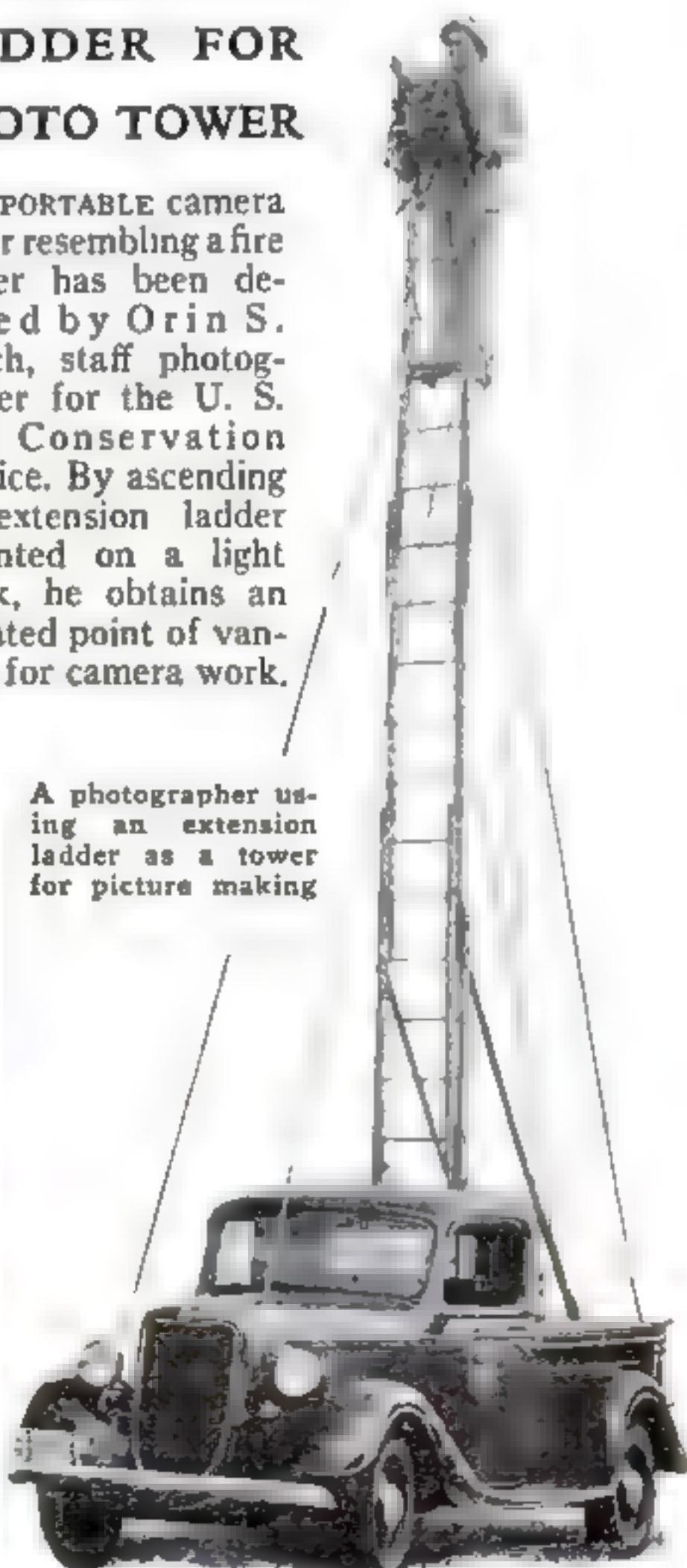


Right, the ball being lowered over the opening 200 feet beneath the surface

CAR CARRIES LADDER FOR PHOTO TOWER

A PORTABLE camera tower resembling a fire ladder has been devised by Orin S. Welch, staff photographer for the U. S. Soil Conservation Service. By ascending an extension ladder mounted on a light truck, he obtains an elevated point of vantage for camera work.

A photographer using an extension ladder as a tower for picture making



Observatory Built By Students

AN EIGHT-INCH reflecting telescope and an observatory on the grounds of the Edgewood School, Greenwich, Conn., was designed and built entirely by the students. Working in the school science laboratories, the boys made each telescope

part piece by piece, relying on their studies in mathematics and physics for accuracy in gear ratios, glass grinding, and astronomical calculations. Long hours of physical labor went into excavating, erecting forms, and pouring concrete for the circular walls of the observatory base. The reflecting mirror was ground from a ship's glass porthole cover, one inch thick and eight inches in diameter, while the 2,000 pound dome was made from twenty-four curved ribs, which were covered with wood

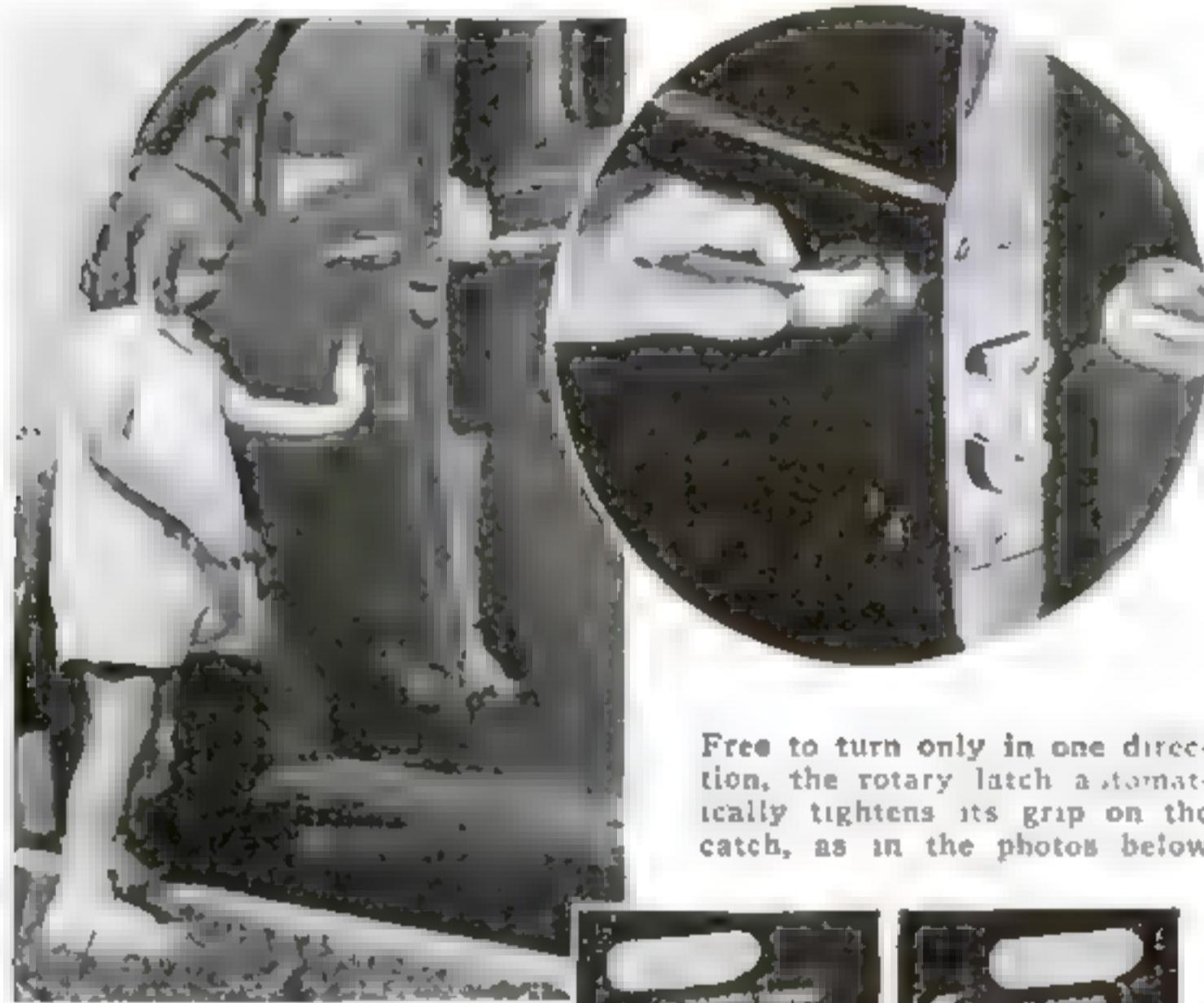
Students sliding the 2,000-pound copper dome for their observatory into place on the concrete base

and sheathed with thin sheet copper. The dome was built separately in a school workshop and moved in one piece to the observatory site. Sliding shutters cover the aperture cut into the dome, through which the telescope tube protrudes.



The work of sheathing the dome was done in the school shops

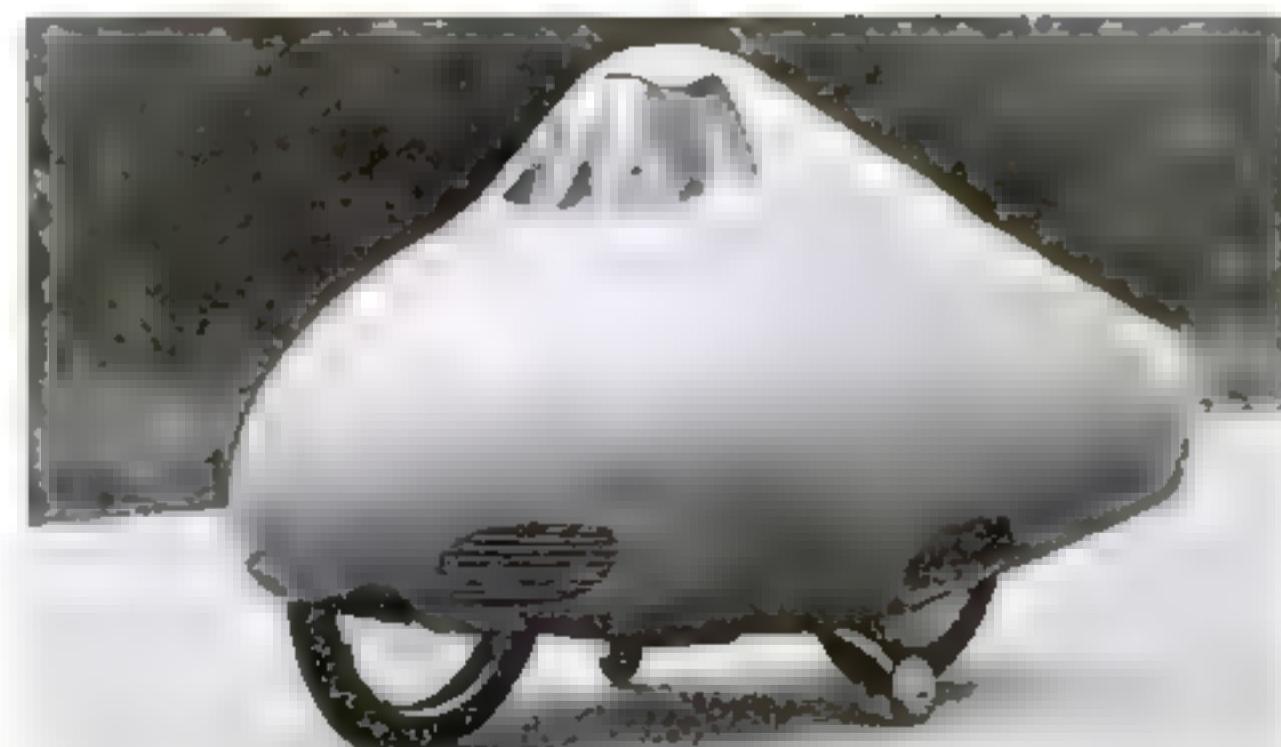
NEW CAR-DOOR CATCH PREVENTS RATTLE



Finger-tip pressure closes car doors fitted with a new anti-rattle, self-tightening latch

STREAMLINE CYCLE MAKES SPEED MARK

RESEMBLING a giant baked potato on wheels, a novel streamline motor cycle recently established a speed record of 170 miles an hour. The odd vehicle, constructed by a German designer, has a one-piece shell of light-weight material which fits over the cycle frame to cut down wind resistance. An unbreakable glass windshield is set flush with the shell.



Two small wheels at the sides support the streamline cycle when it is at rest. They may be drawn in when not needed

ROTARY latches that tighten automatically prevent rattling of doors on a new model of a standard car. A pronged latch, fastened below a guide on the door edge, revolves in only one direction unless released by the door handle. As the door closes, a hook on the catch attached to the door frame engages the rotary latch, and further closing wedges the catch securely between the latch and the guide. Car vibration tends to rotate the latch, thus causing it to hold the door in a grip that keeps growing tighter.



CARVES FIGURE OF BEAR FROM BIG CAKE OF SOAP

A STATUE of a bear, carved out of a single solid block of white soap weighing 1,500 pounds, formed a novel feature of a recent exposition held in New York City. In the photograph above, the sculptress of the unusual statue is seen giving it the finishing touches.

EAR IS RADIO SPEAKER

THE HUMAN ear can act as a radio loudspeaker, according to Dr. S. S. Stevens, of Harvard University. In experiments, ordinary alternating currents introduced into the ear by means of an electrode placed in the ear when it was filled with salt water produced sounds that could be heard.

**STREAMLINE CAR
FOR AIRPORTS •
SPEEDS REFUELING**



This odd three-wheeled vehicle speeds fuel and oil to planes at the Royal Air Force field at Reading, England

**"LUNCH WAGON"
SERVES DOGS**



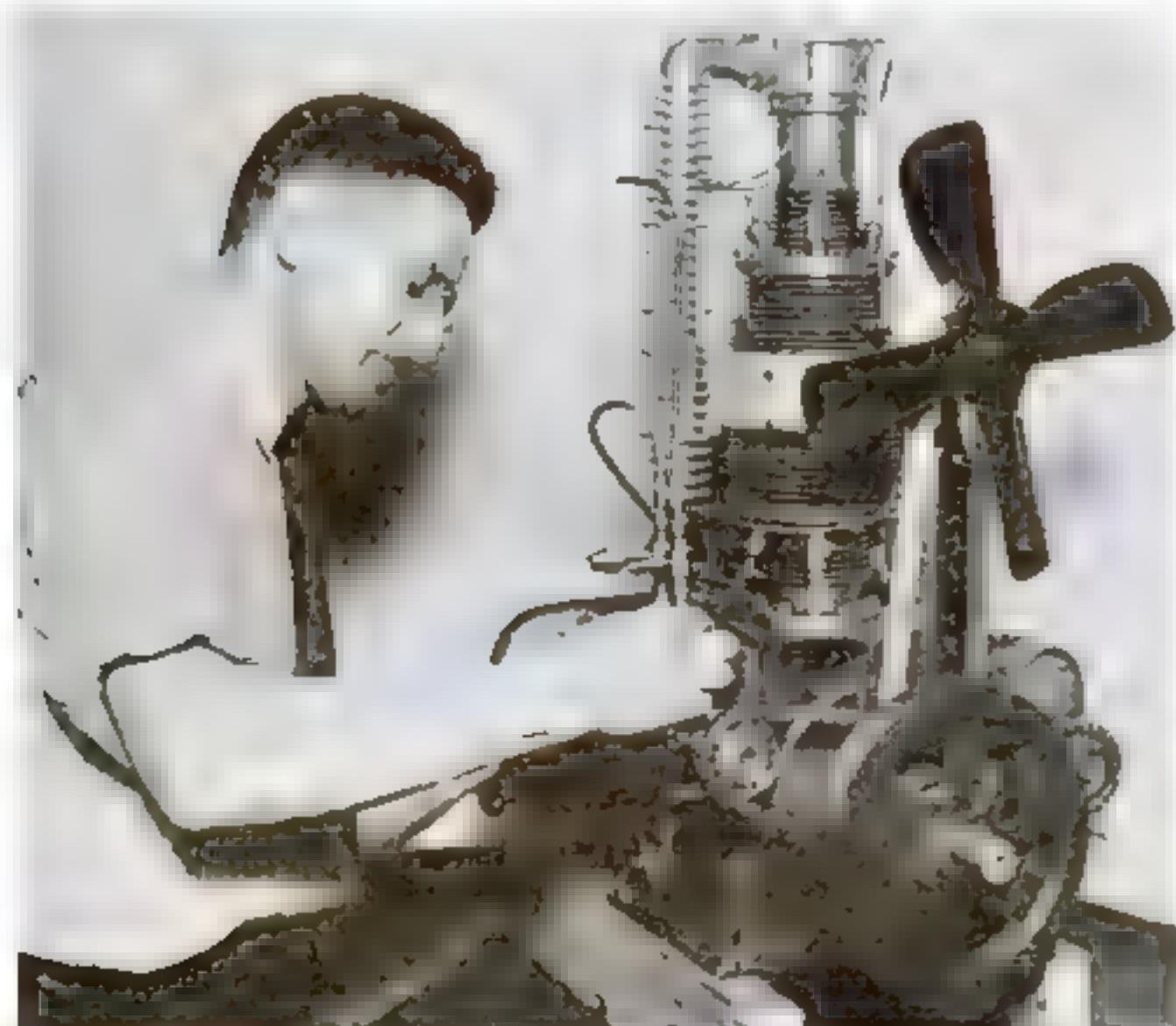
Dog owners treating their pets to a bite at a curbside stand

A TRAVELING restaurant for dogs, recently introduced in Kent, England, provides refreshment for pets on a stroll. For a nominal price, their owners may purchase them a substantial meal of biscuits and milk at the curbside stand. The "dog wagon" provides accommodations for six canines at a time, and the owner is said to be doing a thriving business.

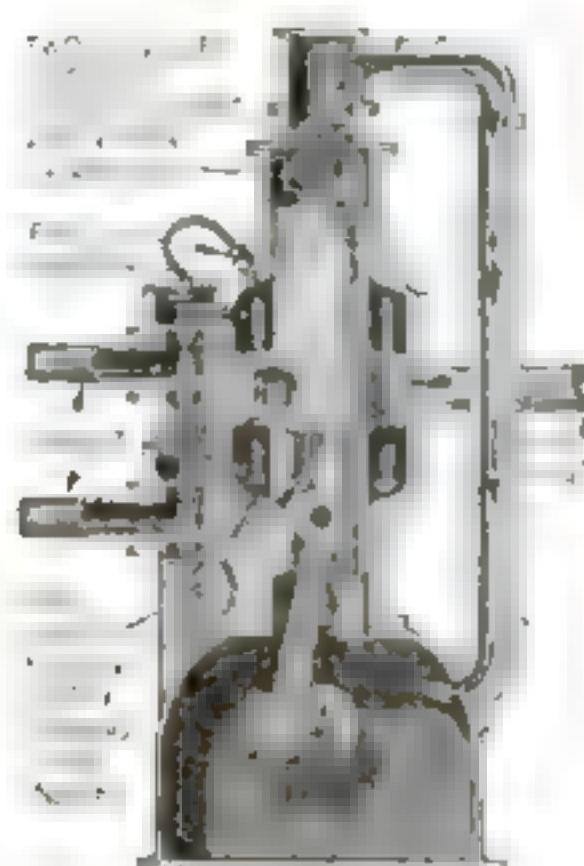
LIGHT DIESEL HAS AIR-COOLED PISTON

RADICAL weight-saving innovations enable a Diesel engine of new design to compete with gasoline motors for airplanes. A power impulse occurs at each end of the piston stroke, and with two-cycle opera-

tion a single cylinder and piston replace four of conventional type. Water cooling is made unnecessary by forcing a stream of air past vanes inside the hollow piston, and then through a finned cooling tube.

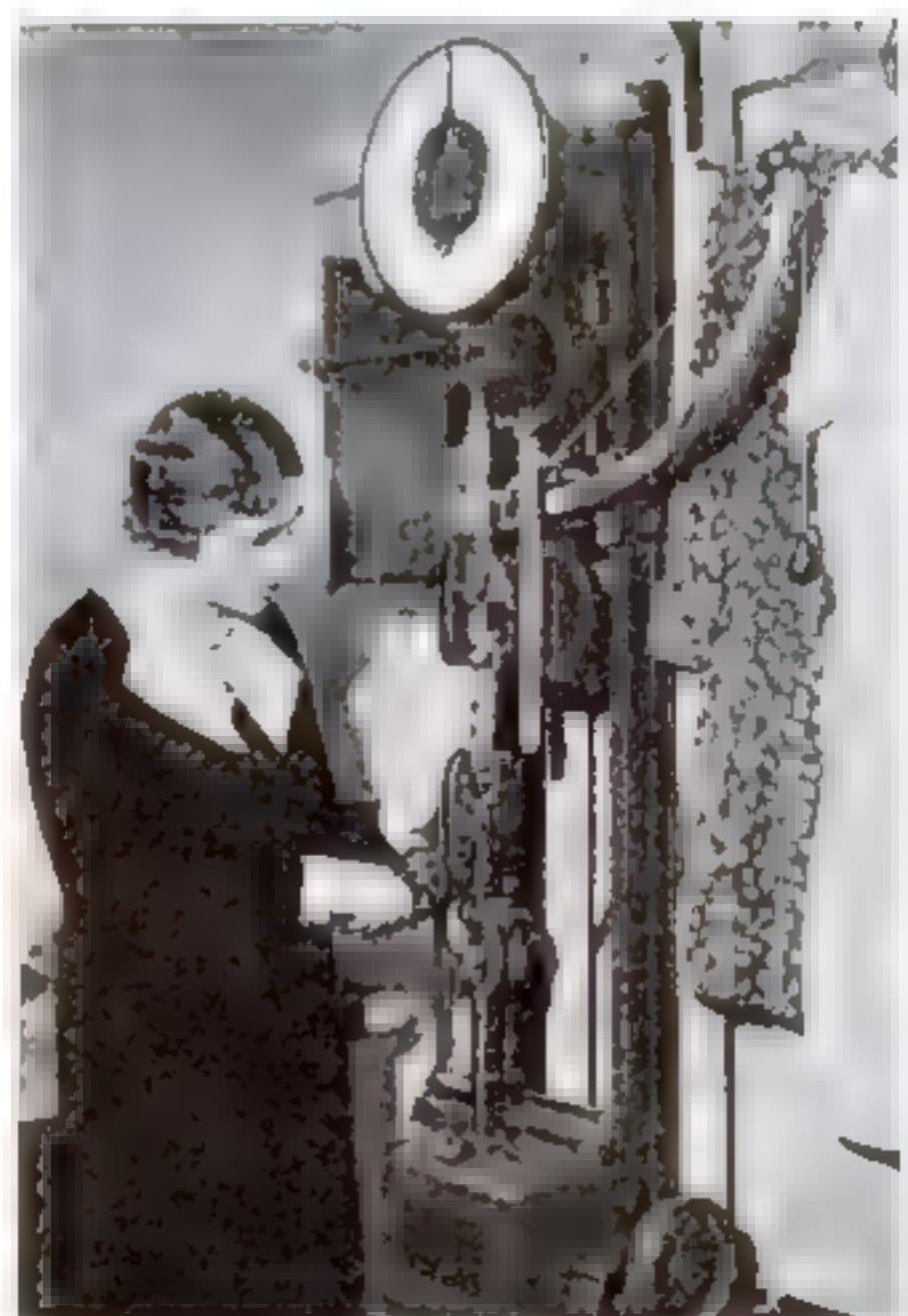


Left, the inventor of the new lightweight Diesel with a working model. The diagram above shows how currents cool its piston internally



**POCKET TOOL CLEANS
EYEGLASS LENSES**

EYEGLASS LENSES are kept clear with a handy new pocket tool, provided with a clip for carrying and used as shown above. Replaceable pads at the ends of the tong-like arms are fed with cleaning fluid from a built-in reservoir.



**MACHINE TESTS FABRICS
FOR WEARING QUALITIES**

How LONG will a new dress last? To find out, U. S. Bureau of Standards experts have devised the machine pictured above, which measures the amount of force it takes to tear the goods. With this and other tests, the research workers hope to set up standards for grading fabrics, so that a buyer may know how much wear to expect from any purchase.

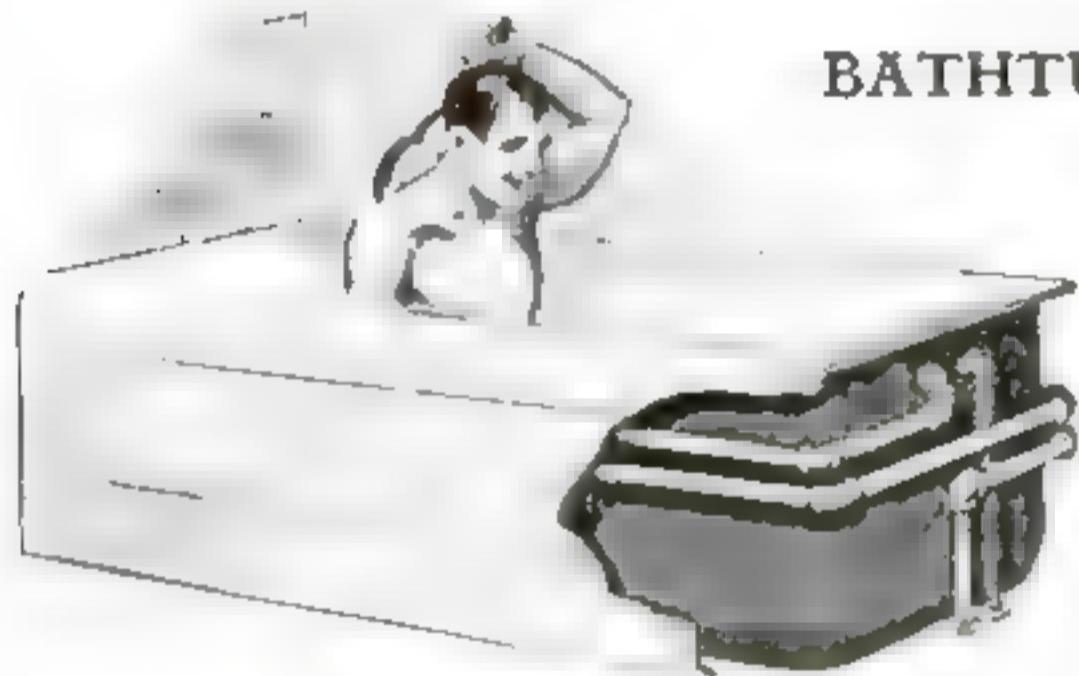


When the subject first hears a gradually increasing sound, she presses a push button as a signal. Right, school children being given a group test.

ELECTRIC DEVICE TESTS HEARING

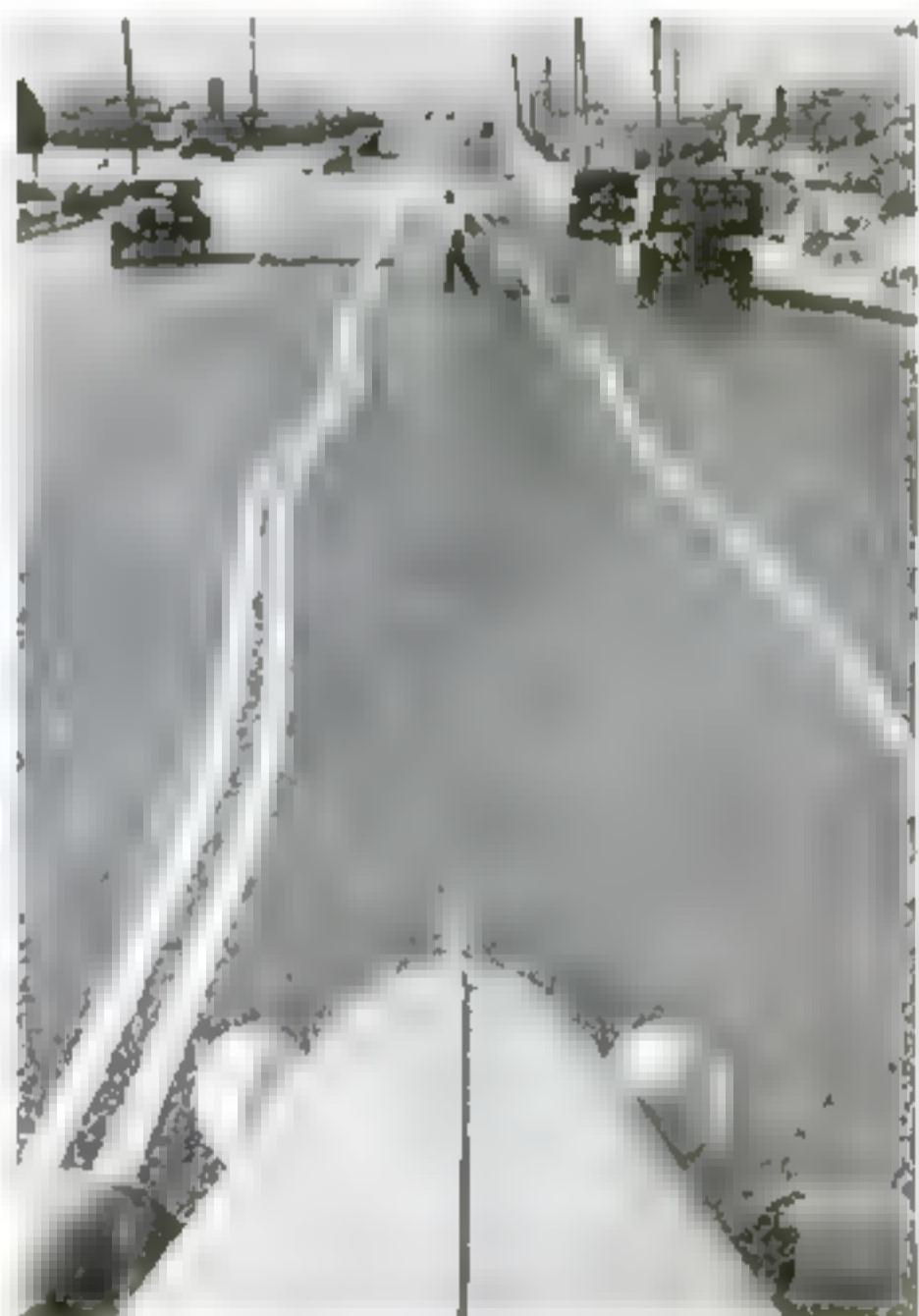
EAR SPECIALISTS are testing hearing with a new apparatus that grades a person's ability to detect faint sounds. Housed in a small cabinet, the electric "audiometer" is plugged into a convenient outlet. In one test, the subject holds a receiver to one ear; at the exact moment he first hears a gradually increasing sound, he presses a hand push button which flashes on a small signal light. The ears are tested

separately with tones of varying pitch, and the results are measured by comparison with a standard hearing scale. In the second test, vibrations are conducted to the hearing organs by the bones of the head. A vibrator is placed behind one ear, while a "masking" attachment blocks perception of the sound by the other ear. With one form of audiometer, as many as forty school children can take the hearing tests at the same time.



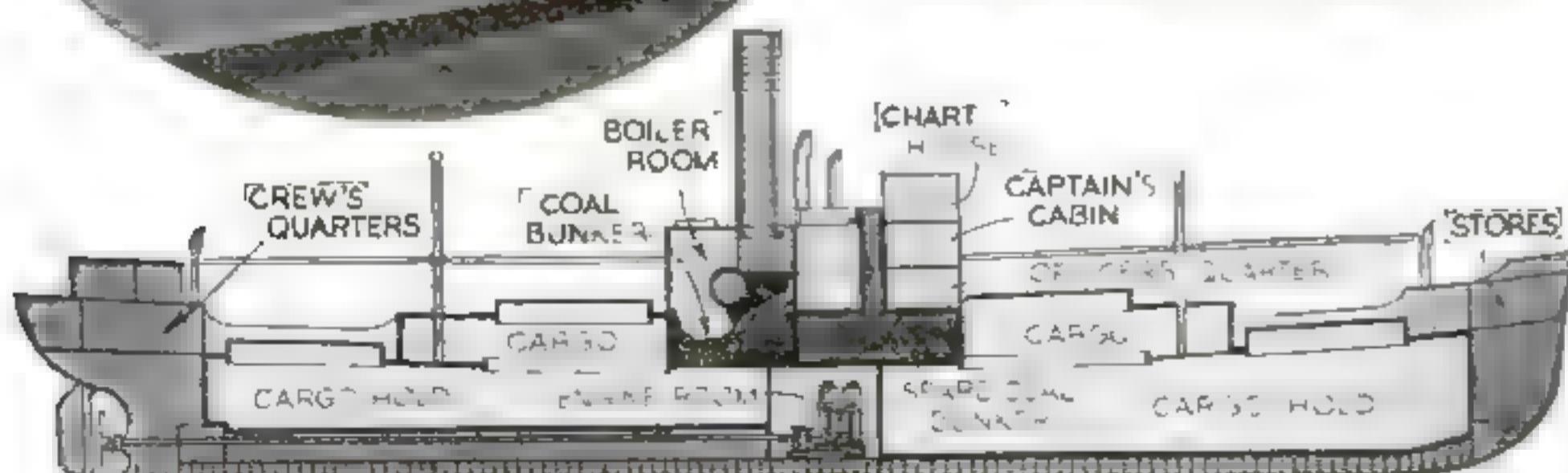
BATHTUB SERVES AS RADIATOR

BECAUSE the bathroom in his home was unheated, a California man made a new bathtub serve as a radiator. Lengths of copper pipe installed under the porcelain cover, as shown at the left, lead the hot-water supply around the tub. As hot water is drawn for a bath, some of the heat radiates outward from the tub walls to warm the room.



SHIP'S STOKESHOLD IS ABOVE DECK

STOKESHOLDS usually are placed deep down within the hulls of ships, but a Norwegian freighter of new design has its firing room and boilers above the level of



Plan of a new Norwegian freighter that carries its boilers above deck level to save cargo space and protect the holds from excessive heat. In the oval is a view of the novel 2,400-ton vessel.

the main deck. Pipe lines connect the boilers with the engine room, which is situated in the conventional position near the bottom of the ship's hull. The unique location of the firing room not only gives the vessel more cargo space than ordinary ships of similar size, but also prevents excessive heat that might be injurious to perishable cargo. Built at Oslo, Norway, the 2,400-ton grain ship is 243 feet long and is equipped with four main cargo hatches and six loading derricks. It is believed that a fleet of freighters of this type may soon be built to transport perishable fruits to America from tropical countries, and for other purposes in which protection from excessive heat is desirable.

WAVY LINES ON HIGHWAY WARN OF BAD CROSSINGS

WAVY traffic lines, painted on the road at either side of dangerous California highway intersections are being tested as warning signals for motorists. It is believed that drivers following white lane markers, in the road as a guide at night or in foggy weather, will slow down when they reach the unfamiliar curving lines.

TRY VACCINE FOR "FLU"

A vaccine that promises protection against influenza is being tested by scientists of the Rockefeller Institute. A group of volunteers has been vaccinated with human influenza virus vaccine and their blood, injected into mice, kept the rodents from getting the disease.



Wind piped to this set through a canvas duct from the blower seen at the right makes shrubbery rustle, without undesirable noise from propellers

A movie chemist filling a fake gas bomb with titanium tetrachloride, which smokes on contact with air



A property for a knife-throwing scene. The daggers, projected from behind, appear on the board as if thrown at it



Aladdins

By
Andrew
R.
Boone

•

want snow that will fall like a mist."

"The director needs another comedy gag for a farm sequence. Can you fix up a featherless duck by tomorrow afternoon?"

"We're shooting thirty men in steam baths Thursday. Give them plenty of steam, but keep it cold."

"We've got to have forty bales of fire-proof cotton by Saturday for the Mississippi River scenes—and say, make that ship look seventy years old."

Twelve men, heads of the property departments at Hollywood studios which turn out 500 feature pictures every year, create in a short time enough new inventions to make them fabulously wealthy—if their devices were practical for general use. But the products of their imagination have a serviceable life of only a day or so, for the average property outlives its usefulness with a single picture.

Their ideas give life, laughs, and surprise to otherwise routine situations; make possible scenes which could not be filmed unless resourcefulness and, in some cases, trickery, created reality for the cameras. A property man may deliver an indoor snowstorm this morning, grow collapsible sunflowers this afternoon, lay plans for a field of cotton tonight, build an airplane almost overnight, or create crazy musical instruments that will really play.

It was on a ranch north of Hollywood, the other day, that I saw seven acres of cotton in full bloom. Three weeks earlier, only grass was growing there. Then the property crew got busy and, with special planting machinery which bored holes, dropped the full-grown plants and tamped the earth in a single operation, started the "building" of a cotton field. In twenty-one days, thirty men set 26,000 plants, wired tufts of cotton on each plant, and presented the director with his "scenery" the night before he planned to bring in his company.

Wire, cloth, wood, metal, rubber, glue, and paint are the materials with which these artisans create most of their master-

IN A little room on the back lot of a Hollywood movie studio, a weary property man turned from his drawing board to the telephone.

"We want seven acres of cotton growing," came the voice of an assistant director. "Stalks two feet tall, and cotton ready to pick. Must have it within three weeks."

Around Hollywood, that week, other property men, the modern Aladdins of the movies jotted down other strange requests:

"We are smuggling a man in from the ocean sewed up in a shark's belly. Fix us up."

"Our crew is felling a fir tree on Stage 2 tomorrow night. We



of Hollywood

CREATE REALISTIC EFFECTS FOR MOVIES

pieces. Many of their jobs are done right in the studios, yet occasionally one goes into the mountains or puts out to sea for some property needed for a special scene. Paul Widliska, who has been thinking up unusual gadgets for fifteen years, got the call for a shark large enough to contain an actor. He drove 300 miles from Los Angeles to Monterey that night. Early next morning, he put out in a fishing boat, and for two days directed a crew as they angled for shark. Three fish came aboard, but all were too small; the fourth, which measured twenty-one feet long, would do.

Back in Hollywood, he stored the shark in a butcher's refrigerator for several days. Shortly before the director called for the smuggling sequence, he had the creature brought to the studio. There he suspended it from a rafter, skinned it, lined the skin with light wood to maintain the original shape, and fitted the belly with a slide fastener.

A dramatic scene was filmed on the stage, fitted out to represent a ship, when a Federal officer, suspecting the shark contained contraband, jerked out a knife and sliced the fish open. Since such an act might have proved disastrous to the actor hidden within, the knife was fitted with a hook which caught an eye on the slide fastener, and the shark was nicely opened.

That problem seemed simple compared with this one: A recent script called for the felling of a large fir tree, to be followed to earth by mistlike snow shaken from the branches. Further complicating the problem, a cloud of snow must rise from the earth as the trunk struck the ground.

As I stood outside the camera line on a sound stage at the Sam Goldwyn studio awaiting the shot, I saw an imitation tree trunk measuring nearly four feet in diameter, standing twenty feet tall, and weighing almost a ton, standing in synthetic snow. The tree was made of plaster, with wood bark, while the glistening snow consisted of granulated gypsum mixed with plaster and baking soda, which caused the substance to "rise" like dough. Carpenters, stationed in strategic positions, held ropes leading to the top of the trunk and to a narrow box, some twenty feet long, suspended above the scene. After the camera crew had jockeyed their machine until it looked directly at the tree and on toward a motion-picture screen which provided the background, the director called for action.

"Lower the tree slowly until it reaches an angle of forty-five degrees, then turn her loose. Turn the snow loose in three batches, the last immediately before she hits. Let her go."

Slowly the great bulk started to topple, gathered speed, and struck the stage, trailed by fluffy white flakes which almost looked more like snow than the real thing.

"The falling snow and the snow on the stage look different," I commented to Widliska.

"The snow on the stage," he explained, "is old stuff. *(Continued on page 122)*



The man in the cabinet isn't as hot as he looks. The steam sent into the box passes through a bucket of "dry ice" that cools it. Thirty-five of these cabinets were used in a single scene

At the right, the false sides of a movie steamboat are being seared with flame from an oxy-acetylene torch to give the appearance of age



Paul Widliska, veteran property man, showing how artificial snow is made by grinding up chicken feathers. Cut to uniform size, the synthetic flakes are sifted down on winter scenes from a revolving drum of wire mesh like the one at right



Piano Keys from Elephant Tusks

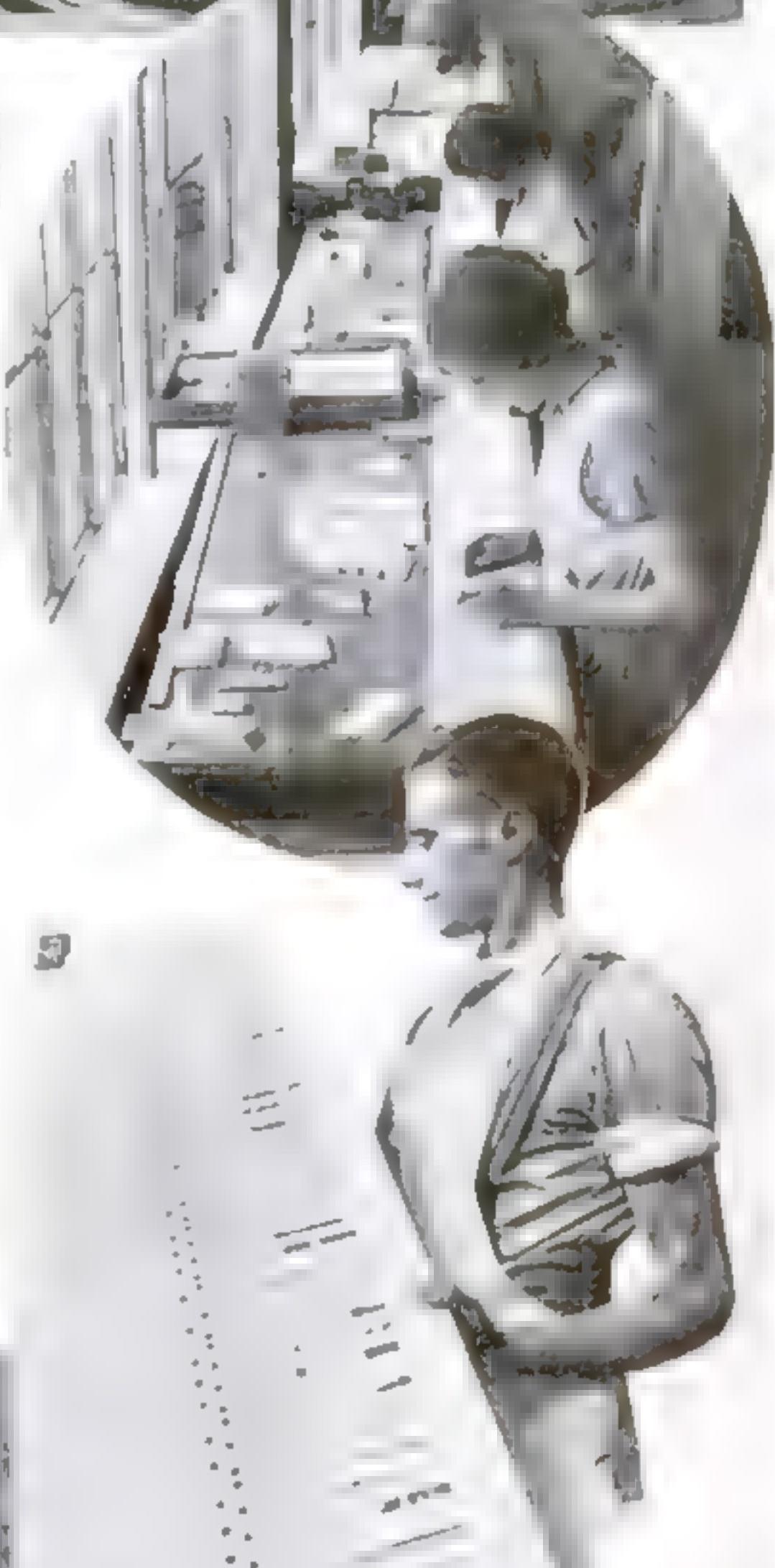
HUNDREDS of elephants lay down their lives every year to provide the pianos of the world with glistening ivory keyboards. Perhaps the shiny keys on your own instrument came from the tusk of a huge beast in the Kenya Colony of British East Africa, or in the island of Zanzibar, for these places produce the ivory that is preferred by piano manufacturers. The photographs on this page show successive steps in the process by which thin strips of ivory are cut from the giant tusks, matched for their delicate coloring, mounted on solid pieces of wood, and then cut apart to form individual keys.

Below, a workman is feeding a tusk into a saw. After being cut into suitable lengths, the ivory is sliced to form the key blanks.

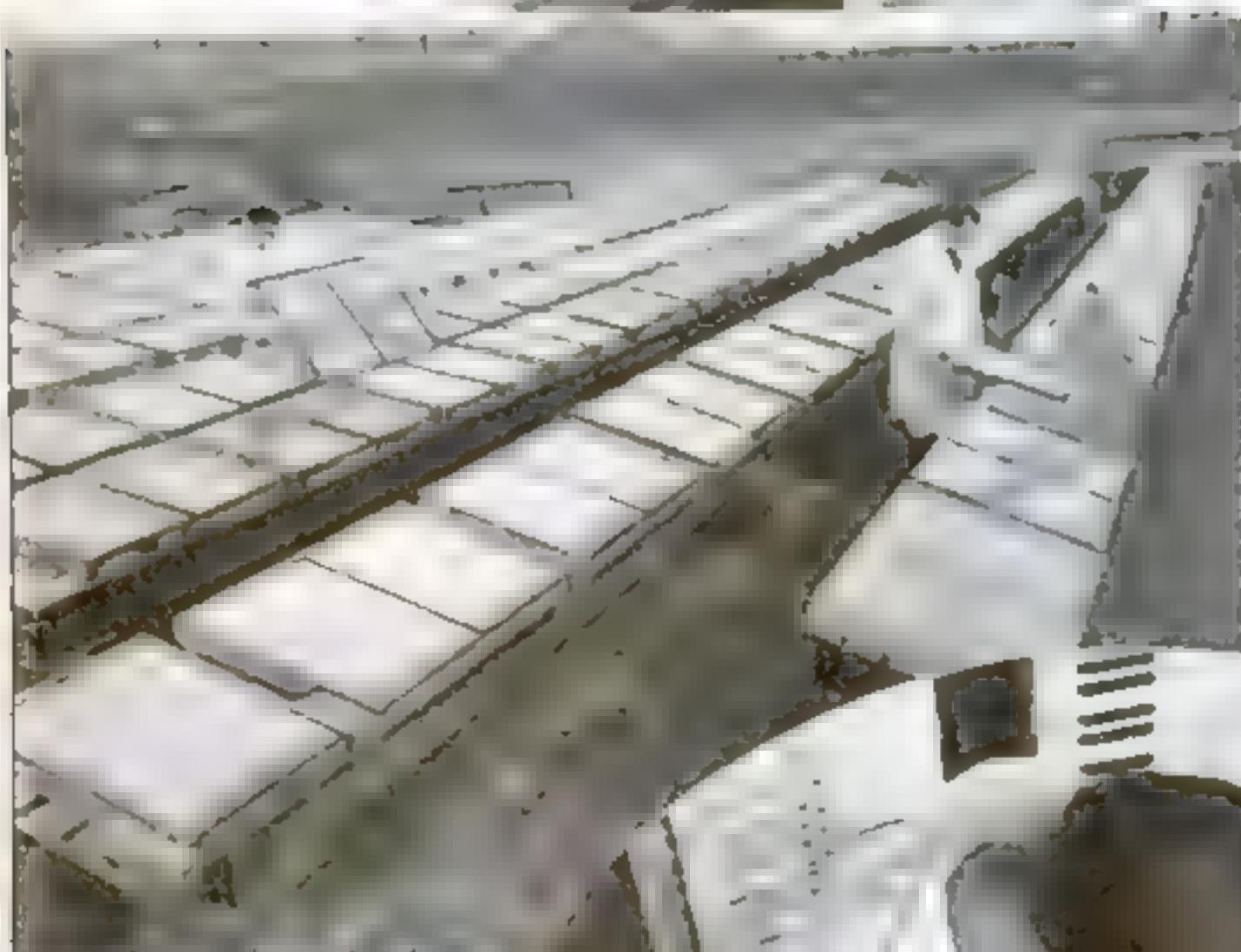


Stacks of elephant tusks in a warehouse. Expert buyers representing piano manufacturers come here to select the ivory to be used in making keyboards.

At the right, girl workers are matching keys for color. Their trained eyes can recognize the slightest variations of shade.



In glass-covered cases like those seen at the left, the ivory strips are exposed to the sunlight. By this treatment, later changes of color due to the action of sunlight are largely avoided.



After the ivory-covered keys have been cut apart, the black keys are fitted into their places as pictured at the right. Polished ebony is usually preferred for these keys. The keyboard is now ready to be put into its place in the piano.



The ivory strips are cemented in place on a solid, continuous piece of wood. Then the keys are cut apart with a band saw.



Fishermen and onlookers crowding the banks of a small Michigan stream during a smelt run. Right, a net half filled with silvery fish scooped from the teeming water



Odd Fishing Carnival

CREATED BY SMELT RUNS IN GREAT LAKES REGION

FOUR THOUSAND people mill in the darkness behind a rope barrier bordering a knee-deep Michigan creek. A signal gun barks. Lights strung along the creek for several blocks flash on. The barrier drops. State troopers cling to trees to avoid being swept along as the crowd surges forward. Yelling and sliding pell-mell down the slippery bank, into the water they go, flourishing nets and buckets.

They're after fish! And, incredible as it seems, they're getting them. Jamming the stream until there is hardly room to stand up, they load pails, sacks, and baskets with their catch—hundreds of silvery, flapping little fellows that can even be taken from the water with bare hands, a half dozen or so at a grab.

That is a picture of a Michigan smelt run—a fabulous phenomenon that must be seen to be believed. Night after night, for two to four weeks each spring, creeks that empty into Lake Michigan, Lake Huron, Lake Superior, and a few inland lakes teem with thrashing fins while the slender fish make their spawning migration upstream to the pools where they breed. Catching them is like dipping fish from a bin. Favored villages witness gala scenes as visitors gather from hundreds of miles away to join in the sport. Carnival queens are elected in honor of the smelt, and in one town the "King of Smeltium" is crowned with mock solemnity. Throughout the state, the smelt becomes front-page news and his illustrious person, properly golden browned, graces platters in homes, restaurants, and hotels.

Behind the picturesque fishing fes-

tivals lies a curious story. Smelt were unknown to the state as recently as 1913, when its fish commission obtained 16,400,000 eggs of a fresh-water variety of the Atlantic smelt from a Maine hatchery and placed them in Crystal Lake in northwestern Michigan. The small fish were to serve as food for land-locked salmon.

Nevertheless, the salmon vanished. For a while it looked as though the smelt had also come to grief. Then, about 1920, someone discovered that Cold Creek, flowing through the heart of the little hamlet of Beulah at the head of Crystal Lake, was nightly packed with the fish. Shunning daylight and traveling after dark, they were actually crowding each other up on the banks!

News of the unprecedented runs spread. Fishermen came from Ohio, Indiana, and Illinois. Beulah's hotels and stores stayed open twenty-four hours a day. State police had to help handle the crowds. They allowed two dipping periods each night, one in the late evening and the other an hour or so before dawn. The rest period gave the smelt a chance to crowd their way into the streams again. A screen above the fishing ground kept the fish from escaping upstream.

Many believed the runs could not last. But they have, and other communities now share the sport. For the smelt, finding his way from Crystal Lake into Lake Michigan, has set out to see the world. So far, he has invaded three of the Great Lakes, and is still spreading. Nothing has been done to protect him. On the contrary, he has been taken by every available means since he first appeared. Other fish have declined alarmingly in numbers and range, despite all the protection thrown about them by law, but the smelt defies all the accepted principles of conservation and continues to multiply—and Great Lakes fishermen are grateful to the ill-fated salmon that brought about the strange invasion which has created this colorful new sport.



These men are dipping for smelt. Board walks are built on stream banks to support the throngs of people who sometimes join the sport. Above is a specimen of the smelt.



UNCLE SAM'S shopping list is one of the longest in the world. Each year, Government buyers go to market for an astonishing list of supplies. The items range from bean bags to road rippers, from fly swatters to baby bonnets, from gold leaf to nightgowns!

The tremendous task of supplying the thousands of things needed by the different branches of the Government is the work of the Procurement Division of the U. S. Treasury. This agency shops for the lowest prices and the highest quality in 2,300 items which are kept in stock, as well as in thousands of others for which it makes contracts. Not only does it buy the pencils, typewriter ribbons, and adding machines used in Washington offices, but it arranges for the supplies that go to Indian reservations in the Southwest, to Eskimo settlements among the Aleutian Islands, and to embassies in Paris, London, and Valparaiso.

The General Schedule of Supplies, published annually by the Procurement Division, forms a sort of "Who's Who" of commercial products. It goes to all branches of the Government, and supplies are ordered by the item number given in the Schedule.

Skip from page to page of this official catalogue, and you find listed twenty kinds of acids, thirteen kinds of cement, thirty-seven kinds of brushes, fifteen kinds of bottles, and eleven kinds of erasers.

You encounter strange names—commodities unfamiliar to the average person—scrim and grommets, squilgees and hake. Scrim, incidentally, is a kind of cloth, grommets are metal eyelets such as are

QUEER THINGS THAT GO INTO Uncle Sam's Market Basket

used in mail bags, squilgees are floor wipers, and hake is a kind of fish.

Among the A's of the Schedule, you find aprons, ashcans, apricots, automobile creepers, and alfalfa hay. At the other end of the alphabet, you discover waffle irons, whitewash, yeast, and steel Z's. In between is a bewildering array of items: corsets, diaries, elixirs, keyhole saws, oyster shells, castor oil, catsup, mule shoes, flower pots, autopsy gloves, movie film, tongue depressors, ice-cream freezers, "little gents'" shoes. Almost anything you can think of is there, except siege guns and battleships. Those are bought by the Army and Navy, which purchase their supplies without the Procurement Division's assistance.

What does Uncle Sam want with corsets, nightgowns and "little gents'" shoes? The answer lies in the hospitals, orphanages, old people's homes, insane asylums, and penal institutions which are under Federal supervision. Each of them adds unusual items to the list of needed supplies.

So many and so varied are the items required, that an immense, two-volume dictionary of supplies has been worked up to standardize the names by which things are known. The project began during the World War. Admiral T. H. Hicks, in charge of the Norfolk, Va., naval supply base, dis-

covered that the same tool or fitting was known by different names in different shipyards. In one instance, a single item had ten names. To prevent misunderstanding, he developed what is known today as the Standard Catalogue of Supplies. In two volumes, each nine inches thick, it records a standardized name for virtually every commodity known to man. Only one item has been discovered that it does not include. This was bean bags, used in the Washington, D.C., public schools.

The other day, I visited the huge white building near the Potomac which houses the buying division of the Government. Officially known as the Federal Warehouse, it stretches for two city blocks and rises seven stories high. Elevators, capable of carrying 10,000-pound loads, link the different floors. Electric trucks scoot about, starting, stopping, and backing like active crayfish. Barrels, boxes, bales, and cartons

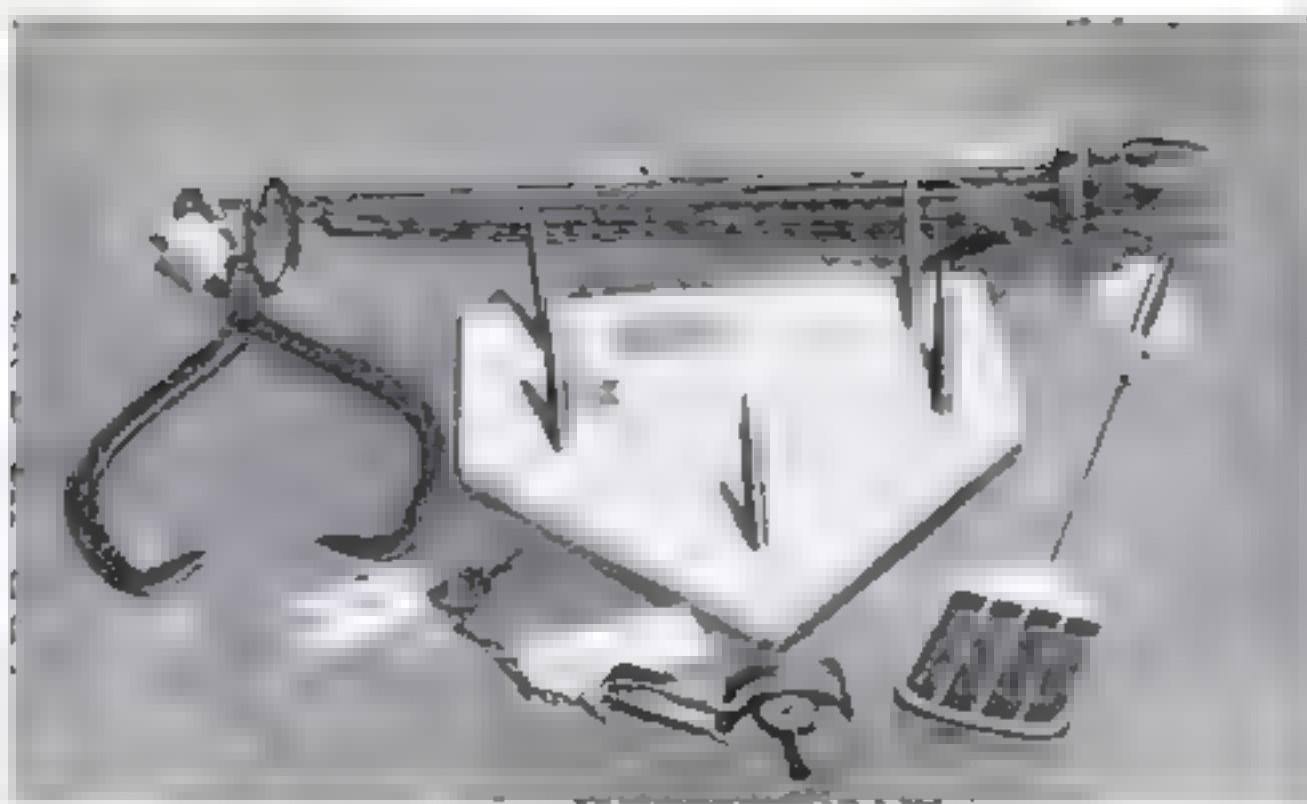
are stacked in piles that reach to the ceiling, with streets and alleys between. The air is filled with the smells of spice and oakum, tea and tobacco.

On one side of this fireproof, concrete-and-steel warehouse, freight-cars discharge and receive goods. On the other, green Government trucks back up to the loading ramp and speed away with goods for local consumption. On the upper floors, a small army of clerks and officials takes care of the details of buying, inspecting, and distributing Government supplies.

On the day I was watching this smooth-running machine in operation, 1,000 cans of sauerkraut and 20,000 pounds of salt



The Government buys a lot of clothing. Here an official is inspecting a row of garments hung in the Federal Warehouse.



Odd items on Uncle Sam's shopping list: a steel trap, ice tongs, a fly swatter, a baseball "home plate," and a massive pipe wrench

were going to a hospital in Louisiana. And that was but one of a host of orders. To speed up the work, all goods are packed on skids with U-shaped legs at the corners. Like strings of cars, these skids form long lines across the warehouse floor when a shipment is being prepared. An electric elevating truck slides under the body of a skid, rises until the skid and its load are off the floor, and then rolls away to the car or truck waiting to receive the order. This mechanized efficiency eliminates the back-breaking labor of lifting and hand-trucking. Electric band saws also play a part in speeding up the work, preparing wood for special packing cases with a minimum of delay.

In spite of the 2,300 items carried in stock, new demands, odd requests, frequently come in and have to be met by the experts of the Procurement Division. It may be birdseed, white maggots, or dental offices on wheels. Once it was 500 dozen quail eggs. Another time, it was a special kind of cod-liver oil obtainable only in Germany. The biggest thing the Federal buyers had to get was a 10,000-pound road ripper for tearing up highways in construction work. One of the smallest, on the other hand, was an order of tiny pins for mounting minute insects.

Some months ago, horses on a western public-works project developed a rare disease. There was no serum in the country to combat it. So the Procurement Division rushed a hurry-up order to a laboratory in Poland for the needed antitoxin. Various emergency projects, which have been a feature of the Government in recent years, have resulted in some of the most unusual of the requests that come to the warehouse office near the Potomac.

In the early days of the present century, each agency of the Government bought its supplies as it pleased. Then, during the Taft Administration, the work of consolidating the buying under a central organization began. At first, this organiza-

tion merely prepared a schedule of awards, a sort of catalogue that gave the prices at which supplies could be bought. The different agencies did the buying from the concerns which had been awarded contracts.

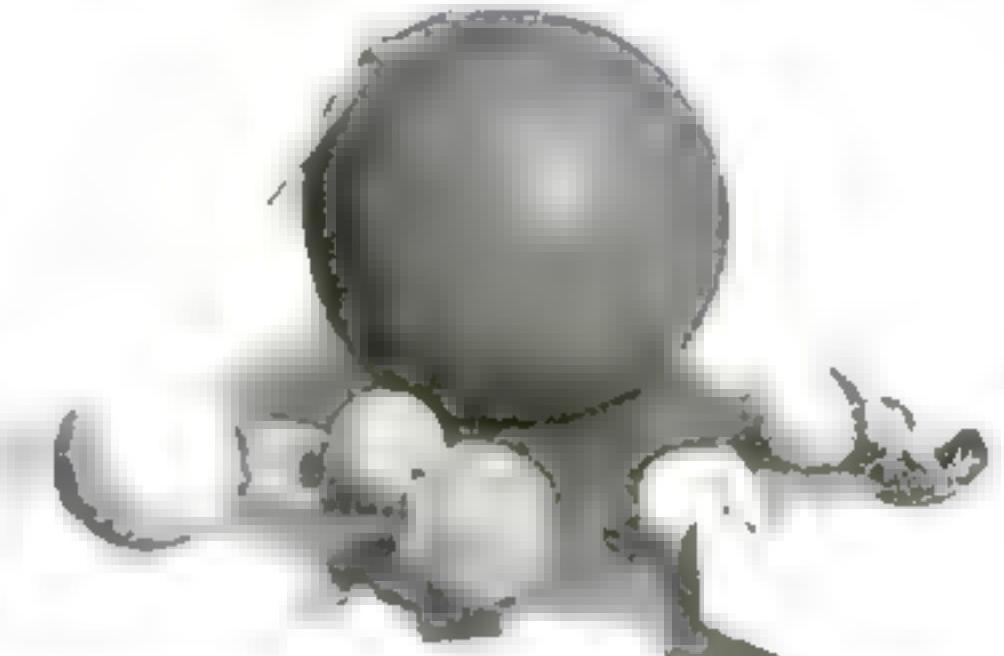
About 1923, the Procurement Division made an experiment by purchasing outright 80,000 automobile tires, a year's supply for the Government. Before that, when contracts were made for tires, the manufacturer had to take into consid-

eration the possibility of a rise in costs before delivery. This meant that, to protect himself, he had to increase the price he quoted. By buying the tires outright, the Division saved the Government thirty-six percent on the purchase. So well did the initial experiment turn out that other items—pencils, typewriter ribbons, rubber bands—were bought in bulk. Today, this list has expanded to include the 2,300 items kept in stock. The latest figures show that the Government uses nearly 800 miles of pencils and three-quarters of a million typewriter ribbons a year.

In one of the offices on an upper floor, you will find a curious directory, a small book containing the names of some 300 men in various branches of the government. Each has knack for drawing up specifications, for describing exactly articles the Government needs to buy. The

preparation of such specifications forms the first step in making a purchase. Manufacturers examine the specifications and make their bids. The one offering the best price and product gets the contract. With the bids often come samples for testing. Nearly 25,000 samples a year are received by the Procurement Division headquarters in Washington.

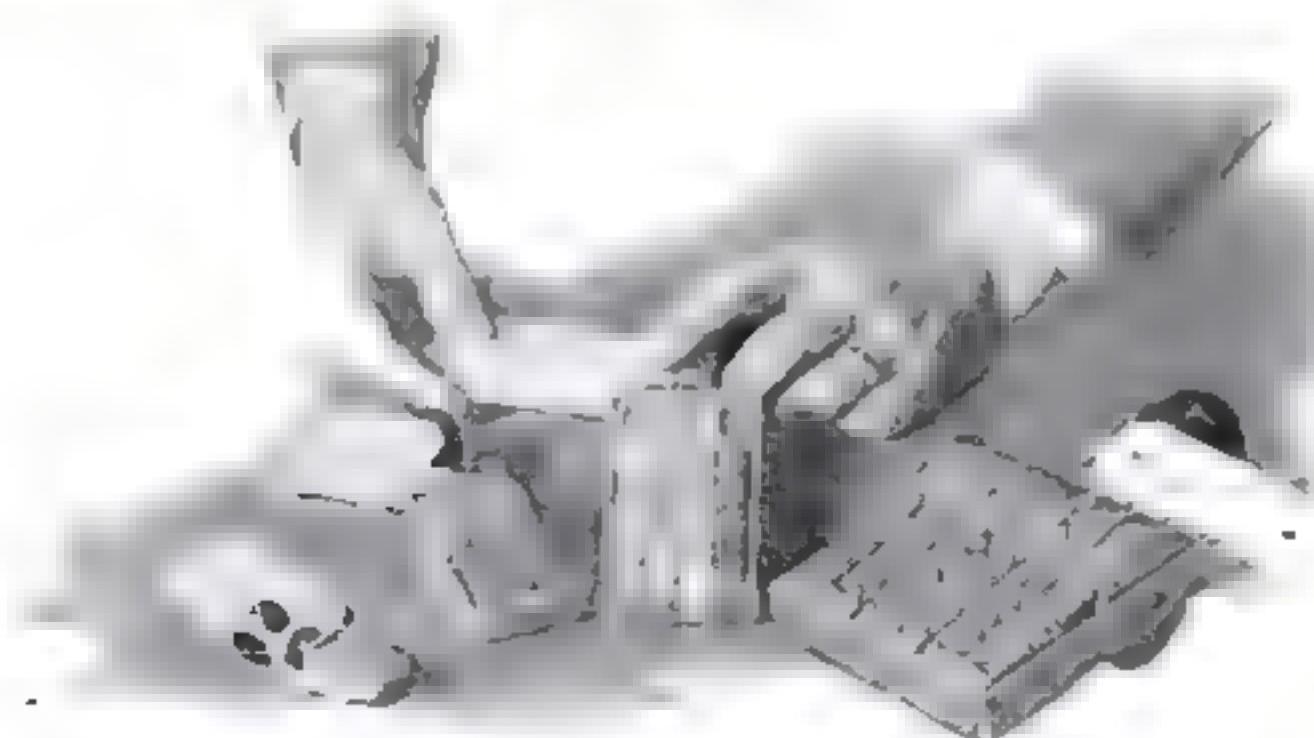
The sample room, with its endless rows of steel shelves holding everything from rat traps to baby shoes, is one of the most fascinating parts of the Federal Warehouse. Each item, as it comes in, is given exhaustive tests, either at the Warehouse or at the laboratories of the various departments of the Government. As soon as it is accepted, the sample is tagged and filed on one of the steel shelves. If it is a stock item, it receives a white tag; if it is contracted for by the year, it is given a red tag. A hand truck, half full of accepted samples, was moving up and down between the shelves when I visited the room. Given an individual number, each sample is filed for reference. Clothing, glassware, rain gauges, steel (*Continued on page 109*)



By
Arthur A.
Stuart

MISCELLANY

Right, specimens of laboratory glassware on sample shelves at the Warehouse. Upper right, various types of recreation balls bought for Government institutions. Below, rubber stamps for Federal offices, an important item in Government supplies



Glass Telescope Model



A scale model of the world's largest telescope. The arrow points to the figure of a man, for comparison of size

LOOKING like a miniature siege gun in a futuristic mounting, a glass scale model of the world's largest telescope, now being erected on Mt. Palomar, Calif., was exhibited recently in New York City. The \$6,000,000 instrument will have a tube twenty-two feet in diameter and sixty feet long, with an observing cage built into one end. Scheduled for completion in 1940, the mammoth 200-inch reflecting telescope will double the present range of human vision into outer space.

WINGED PIN CAN'T BE SWALLOWED

MOTHERS can rest assured that their babies will not swallow safety pins of a new type recently placed on the market. The novel "swallowproof" pins have wide, wing-like arms attached to the prongs. These broad wings make the pin too large for the baby to place in his mouth while not being watched.



Wing-shaped arms make it impossible for a baby to swallow the pin

ATMOSPHERIC PRESSURE SETS VENEER



Veneer work sealed in a rubber bag from which air is being evacuated

WITH a new vacuum machine, veneers can be applied to irregular surfaces without the use of shaped forms and presses. Veneer is glued to the base in the usual way, and it is slid into a rubber bag. The latter is then sealed and pumped free of air. When a vacuum has been set up within the bag, each part of the work is subjected to an even atmospheric pressure of about thirteen pounds to the square inch, which sets the veneer.



BARROW SCOOPS UP SNOW

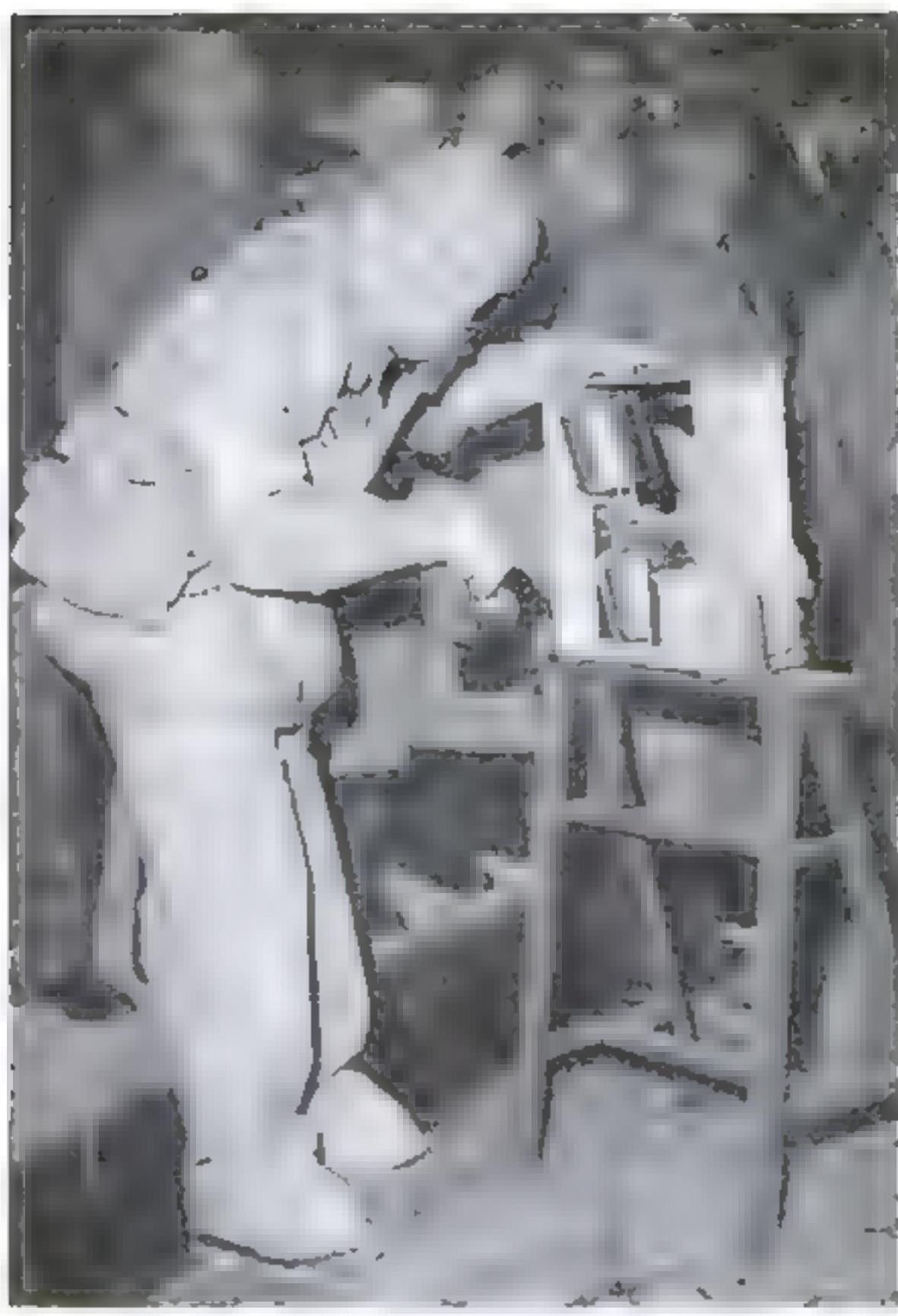
Snow is easily cleared from sidewalks and driveways with a wheelbarrow introduced recently. Built on the lines of a large shovel, the body of the barrow scoops up the snow as it is pushed forward, and is tipped up to dump it.

AUTOS ARE COUNTED BY ELECTRIC EYES

VEHICLES passing a given point are automatically counted by a new traffic-recording device just introduced. Two infra-red lamps, housed a short distance apart and mounted on one side of a road, cast invisible beams across the highway to a photo-electric receiving unit on the other side. Interruption of the two beams by an auto actuates an electrical counting device, which can be set to total the number of passing vehicles by the hour, day, week, or month. Pedestrians are not counted, since the apparatus is so constructed that it registers only when both beams are blocked at the same instant.



Passing vehicles intercept parallel beams of light and are counted by a photo-electric recording device



PORABLE OUTFIT ANALYZES GAS

AS A PROTECTION for civilians in wartime gas attacks, portable gas-analyzing apparatus is being tested in European cities. Rushed to sections under attack, the outfit will enable its operator to determine the nature of the gas present, so that the proper antidote can be administered to gassed persons. The illustration shows a test made during a mock air raid.

PEDESTRIANS GET HONKING CANE

WITH a "honking cane" recently invented, a pedestrian can make his presence known to motorists when he crosses busy street intersections. Intended primarily for use by the aged, the lame, and the blind, the stick has for its handle a rubber bulb that produces a honk when squeezed.

GLUE REPLACES NAILS IN PREFABRICATED WOODEN HOUSES



One of the small prefabricated houses now being produced commercially in which a special moisture-resisting glue is used to hold the various parts together. At the right, workmen are seen assembling the framework of a house by this novel method

THREE-IN-ONE PARACHUTE TESTED



Odd-shaped three-in-one parachute being prepared for trials in France. Note the perforations in the fabric

A NEW PARACHUTE of odd design, recently demonstrated in France, is said to insure safe emergency landings for airplane pilots. Essentially three 'chutes of various sizes combined into one, the safety device is re-

puted to open in three seconds and descend at a much slower rate than conventional types. Perforations in the fabric, the inventor claims, help check falling speed, and the direction of descent can be controlled. When extended, the 'chute has a surface area of about fifty square yards.

JACK LIFTS SIDE OF CAR



Attached beneath the running board, this jack is swung out to lift the car

ONE SIDE of a car is lifted clear of the ground by a new automobile jack. Housed beneath the running board, the hinged jack swings out into a vertical position and tips the car upward as a horizontal handle is turned. The novel built-in accessory speeds tire changing and makes it easy to get under an automobile for repairs. The photo at right shows a close-up view of the jack in position.

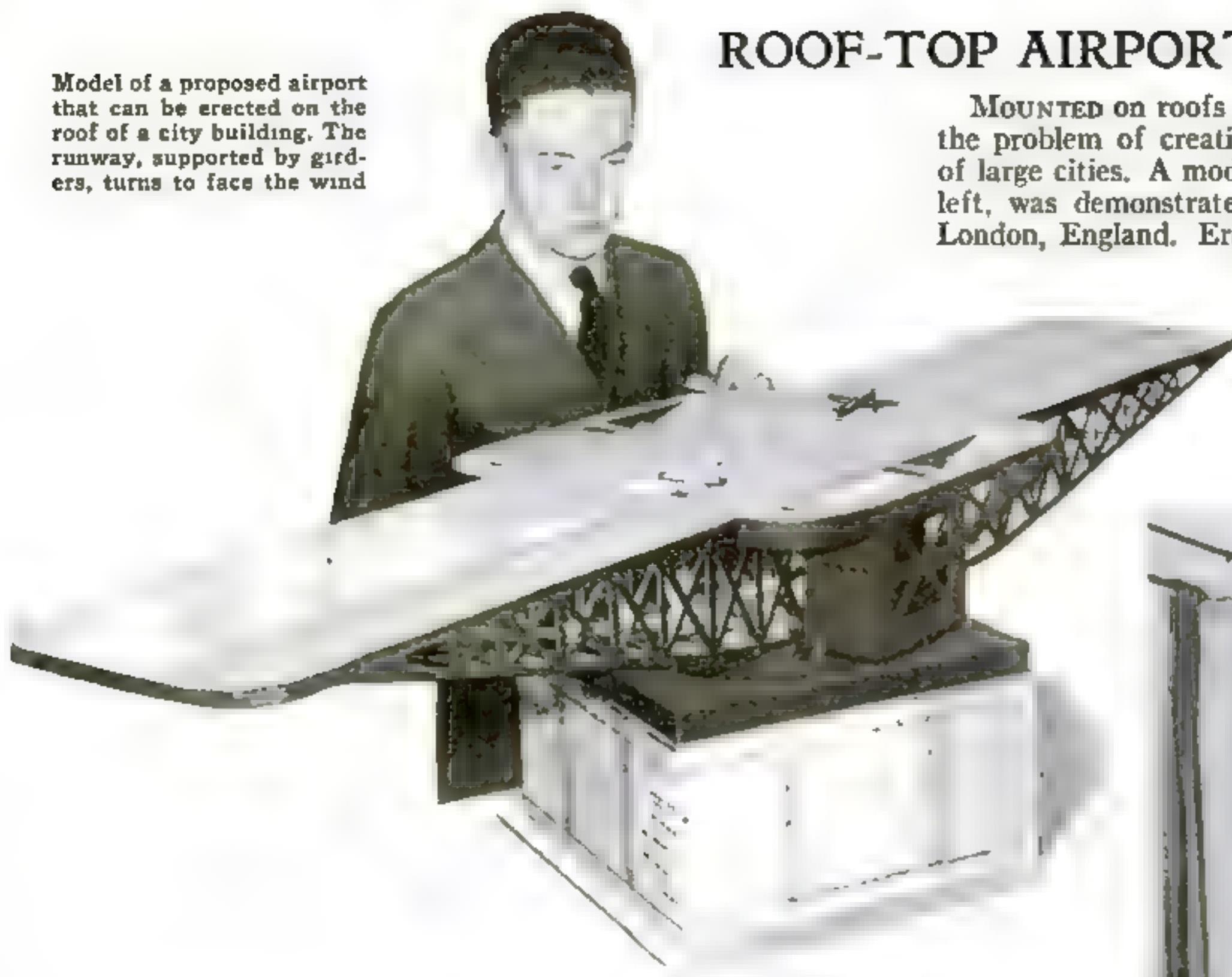


GLUE takes the place of nails in prefabricated wooden houses now being produced commercially. Walls, floors, and roofs of the novel homes are fastened to structural beams and studding with a glue that is said to be moisture-resistant, immune to wood-boring insects, and actually stronger than the wooden members it connects. Extensive laboratory tests, it is stated, show that glued houses are more rigid than conventional structures.



ROOF-TOP AIRPORT TURNS WITH WIND

Model of a proposed airport that can be erected on the roof of a city building. The runway, supported by girders, turns to face the wind



MOUNTED on roofs of office buildings, rotary airports may solve the problem of creating adequate landing fields within the limits of large cities. A model of such an elevated airport, shown at the left, was demonstrated at a recent inventors' exhibition held in London, England. Erected on a steel-girder foundation, the long, overhanging runway resembles the deck of a large naval aircraft carrier. Machinery housed within the supporting structure would turn the rotary airport so that planes would always be able to take off or land into the prevailing wind.

DUAL VACUUM TUBE IS NEW TELEVISION AID

A NEW vacuum tube of novel construction, devised by two New York electrical experts, may prove an important aid to the development of television. Designed to furnish ten watts of power on a one-meter wave length, the new unit, which is in reality two tubes in one, promises to solve the problem of obtaining high stable power for television broadcasts on the ultra-short waves. In this way, it may help engineers to hurdle one of the main obstacles now in the way of the early development of practical television broadcasting.



The new vacuum tube displayed by its two inventors



GIVES RADIUM TREATMENTS BY REMOTE CONTROL

RADIUM is administered to cancer patients in an English hospital with the aid of an electric apparatus that is operated by remote control to protect the attending doctor or nurse. Wires running over pulleys attached to a swinging arm on the ceiling lift the lead radium container from a bedside storage safe. The revolving arm then swings the radium "bomb" and lowers it into a receiving container strapped to the patient.

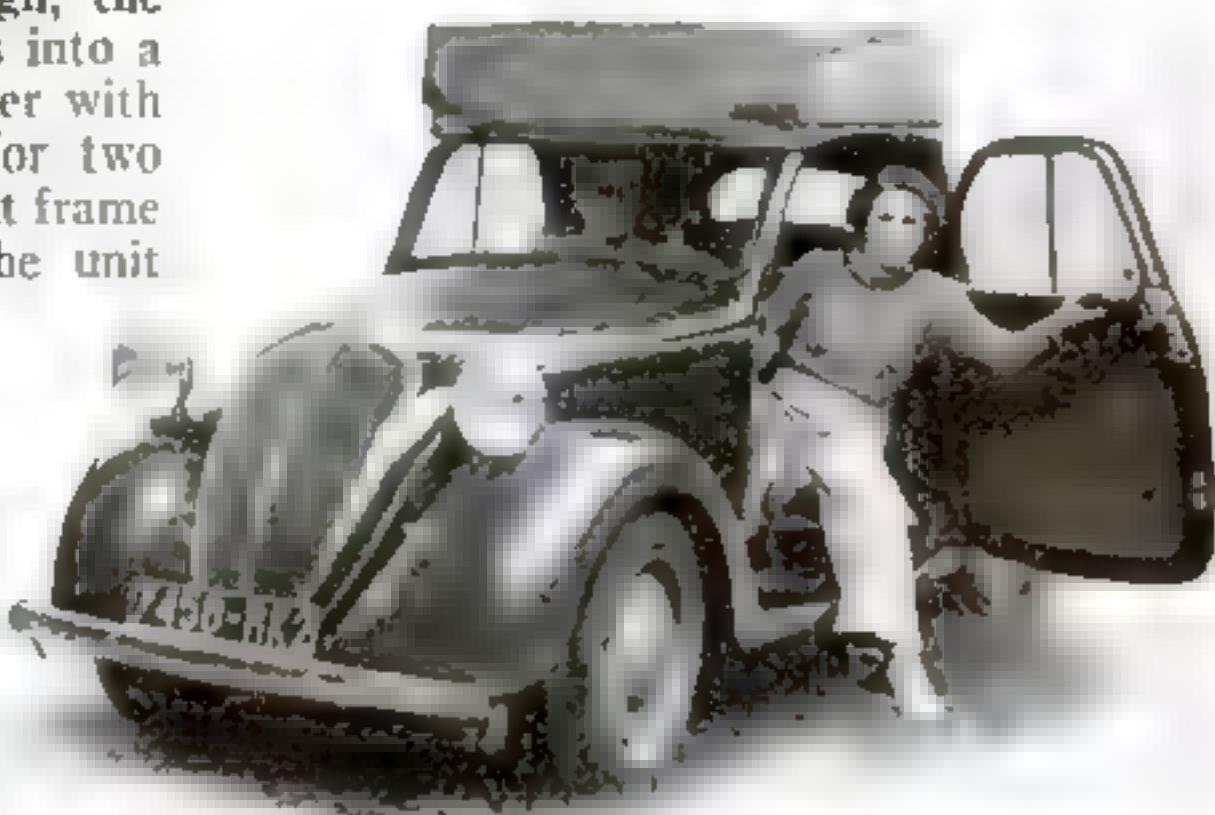
CAR TOP CARRIES COLLAPSIBLE TENT

FASTENED to the roof of an automobile by a steel framework, a collapsible tent provides sleeping quarters for tourists and campers. From a compact unit barely a foot high, the accessory unfolds into a comfortable shelter with sufficient room for two sleepers. The front frame which steadies the unit

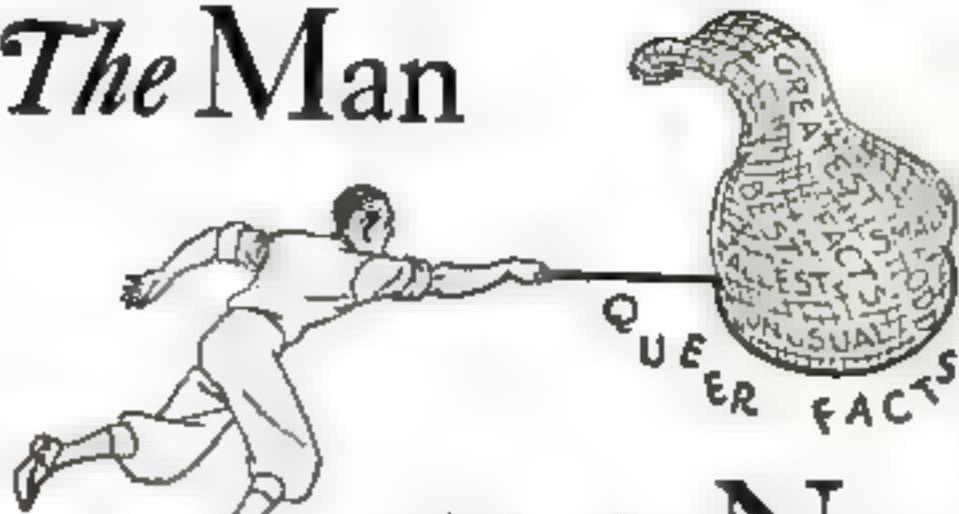
when in use also serves as a ladder for entering or leaving the tent. An adjustable flap on the front side of the canvas shelter insures adequate ventilation. The roof-top tent can be set up ready for use within ten minutes, it is claimed.



At left, the folding car-top shelter is seen set up for use. The frame that steadies it in front also serves as a ladder. Right, the unit as it appears when folded up for traveling



The Man



with the Net

EAGLES have eyes that weigh twice as much as their brains.

ARKANSAS is surrounded by six other states, yet a person in Arkansas can walk south into any of them.

HAIR BRUSHES were invented by the Chinese general who was in charge of building the Great Wall.



NEW YORK CITY contains 2,700 cows, all producing milk for local consumption.

MACHINES for milking guinea pigs have been designed by two Evansville, Ind., inventors. Guinea-pig milk, they say, is richer in fats and proteins than cow's milk.

LEGS and arms decrease in size a measurable amount when a glass of ice water is consumed. They increase a measurable amount when hot coffee is drunk.



SHARKS are said to be most dangerous at dusk.

LION HUNTERS entering Nairobi, Africa, have to pay a \$500 license fee on each gun they carry.

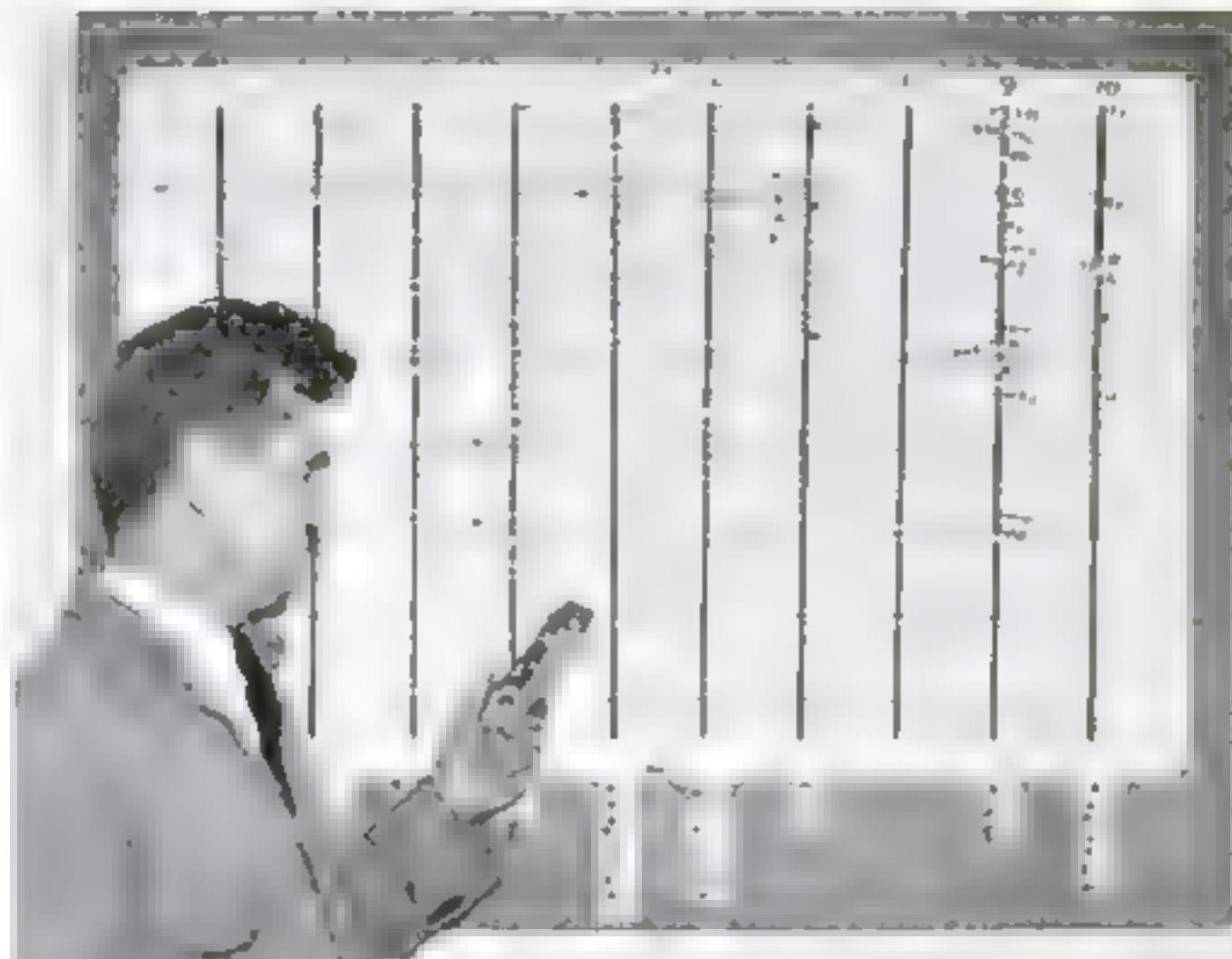


HUMAN SKULLS—13,000 of them—are stored at the American Museum of Natural History, in New York City. They are kept in labeled boxes arranged like books on a library shelf.

INDIA is the home of giant hailstones. During a single storm, the balls of ice are reported to have killed more than 100 natives.



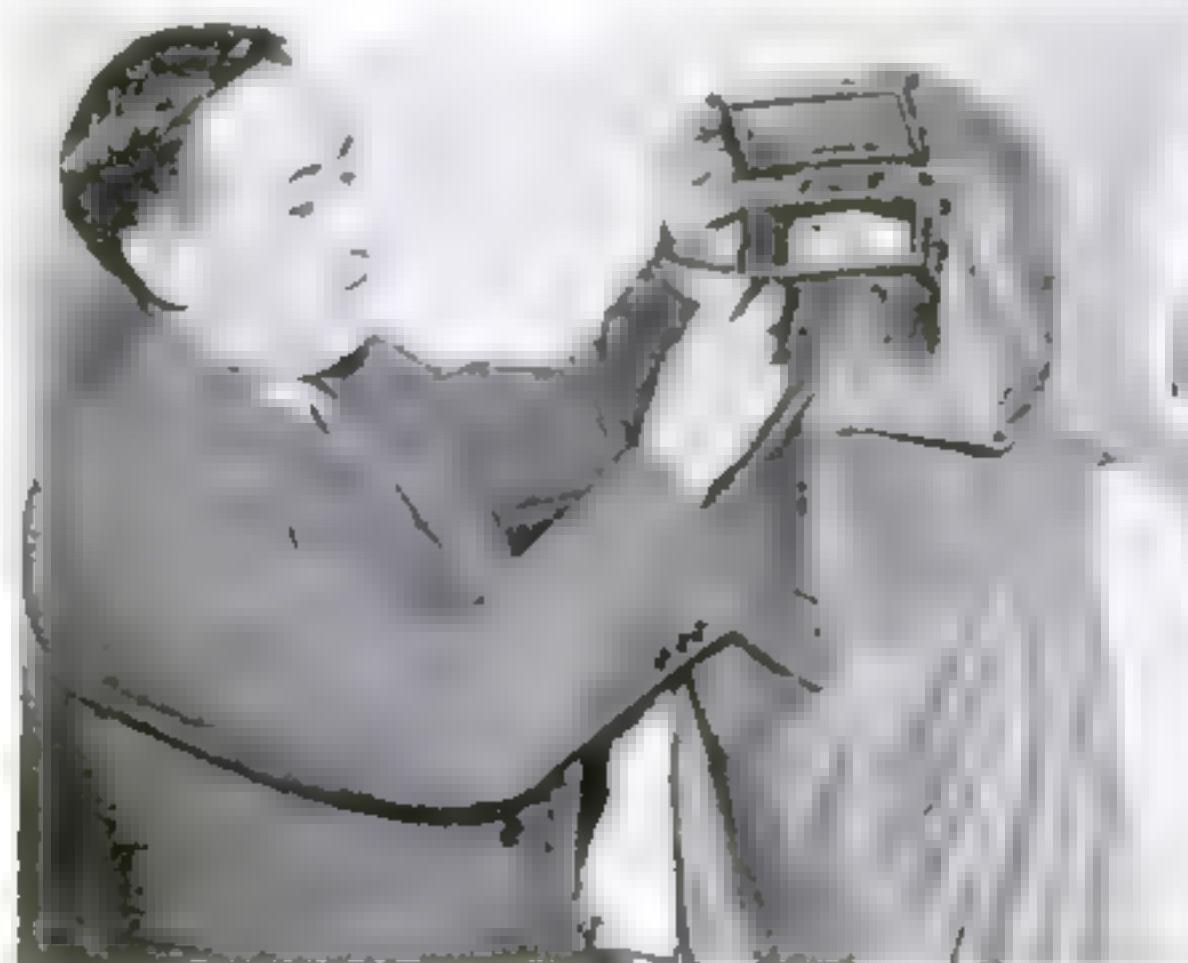
COLORED CORN KERNELS TEST HEREDITY



"Inheritance chart" for checking heredity experiments with corn

DUST MASK HAS EMERGENCY FILTER

WORKERS engaged in tunneling, mining, or sand-blasting are said to be given complete protection from dust by a new, lightweight mask which is strapped over the face and covered with a hood that exposes only a rectangular window at eye level. Dust-free air is fed in through a flexible rubber tube connected to an air-supply line. If the air supply fails, the worker can disconnect the hose, and breathe through a built-in filter in the end of the tube.



The new dust mask, showing the filter in the intake tube for use when the air supply fails. Left, adjusting the silk hood that covers the face except for a window

AUTO REFLECTORS TRIM HANDBAG

REFLECTING BUTTONS are sewn on both sides of a new handbag as a safety measure for women pedestrians at night. When the owner walks along a highway or crosses a badly lighted street intersection, her handbag reflects the lights of oncoming cars to warn them of her presence.

SAFETY SEAT FOR AIRPLANES

AIR CUSHIONS may soon replace the safety belts worn by plane passengers to prevent injury on take-offs, landings, or in "bumpy" weather. Perfected by two Los Angeles, Calif., inventors, a new airplane seat has cushions built into its sides near the arms. At the turn of a convenient valve, compressed air flows from a central storage tank and inflates the cushions, molding them around the passenger's thighs and holding him securely but comfortably to his seat.

The ornaments on this handbag are reflector buttons



SNAKES

HERE IS THE INTERESTING STORY OF A MAN WHO SPENDS HIS TIME HANDLING BIG REPTILES AND MAKES LONG TRIPS TO THE FAR CORNERS OF THE EARTH TO FIND NEW, DEADLY SPECIMENS



C. B. Perkins with one of his pets in the modern reptile house that he designed for the San Diego, Calif., zoo. Sunlight beats down through skylights into the air-conditioned cages. Below is the outdoor gallery from which visitors view the snakes through vertical windows set into the wall

he never rattled once when I caught him."

"Beautiful?" I shuddered. "Are any snakes pretty?"

"Come with me," he said, by way of answer, and we started on a tour of the zoo's new reptile house. We walked first through a long corridor of cages which resemble aluminum baking ovens—a new means for showing reptiles, which expresses Perkins's ideas of modern display. Each cage, he told me as we proceeded, faces a window. Each contains from one to a half dozen reptiles, from the deadly Gila monster to the nonpoisonous and not-so-deadly eighteen-foot python. Sunlight beats down through open skylights directly on the reptiles, yet the temperature and humidity of the various groups of cages are controlled to give them conditions best suited to individual temperaments and requirements.

As we emerged from the corridor and rounded a corner into the open-air colonnade from which visitors look at the specimens, I began seeing snakes—a rare and deadly, though sluggish, dolichophis, that Perkins had captured in Java only a few weeks before; a friendly boa constrictor and a big

IT WAS thirty-three years ago that C. B. Perkins started collecting reptiles. To the consternation of several mothers in his neighborhood in Denver, Colo., he brought together in a grand assemblage five garter snakes and four bull snakes, which he draped around the canvas walls of a side show prepared by his youthful companions. The snakes were his contribution to the exhibit.

For several weeks thereafter, he spent much of his time trying to justify to his parents his interest in the outdoors, and particularly in creatures crawling thereon and in. A year or two later, he was at Princeton University studying zoölogy; during the years of early manhood he pursued his love of snakes, and today finds him collecting reptiles from the far corners of the world and caring for them in the world's most modern reptile house.

When I visited the San Diego, Calif., zoo, whose hilly acres roll over a generous part of that city's 1,400-acre Balboa Park, I discovered this enthusiastic herpetologist trying to revive a red diamond-back rattler, which a few minutes earlier had literally beat out its own brains against the glass window of its cage in anger at the poundings of some visitor who had disregarded the warning sign,—"Do Not Tease."

"Beautiful creature," he murmured, without looking up, as I entered the room. "He had such a lovely disposition. I remember that



The "snake man" pays a visit to the eighteen-foot articulated python in its cage, while visitors look on breathlessly. He has been bitten several times by this huge serpent, but is careful to avoid its deadly coils

Are His Friends

By
GROVER C.
MUELLER



Here Perkins is examining a red diamond-back rattler which has beat out its brains against the walls of its cage as the result of teasing. Left, how a snake is captured with a noose held on the end of a long stick

python; California red racers; seventeen varieties of rattlesnakes; a tiny steel-blue worm snake, measuring only six inches long; king snakes, bull snakes, gopher snakes—a total of 238 snakes, one of the finest collections on exhibit in the world today. All are housed within smellproof, virtually verminproof cages, each separated by one foot from its neighbors. The cages periodically are emptied and wheeled into a sterilizing room where high temperatures kill all animal life; then the metal homes are returned to their show windows, as good as new.

But—beauty in snakes?

"Take that articulated python in the corner cage," Perkins said, at last. "He's one of the most graceful creatures that ever lived. Note how the colors in his skin blend and shine. There's no better sheen on any fine cloth. Wait a moment, and I'll show him to you in action."

A moment later, he walked through the low door at the rear of the cage, and ap-

proached the snake. He touched the skin somewhere along the back. The python wriggled its figurative ears. He prodded the sleeping beauty, and it arched its back in protest. Again and again, he gently disturbed the snake, until it awoke from its lethargy and made for a tree trunk which virtually filled the cage. Then, with my eyes glued to the glass, I saw epitomized in one of the hugest crawlers of the tropical forests the lithe beauty and symmetry which first attracted C. B. Perkins to reptiles a third of a century ago, and which have kept him on the go ever since, always hoping for something new and large and deadly—and beautiful.

Perkins knows his snakes. He can tell you, after the briefest acquaintance, which among the poisonous specimens he can trust to wriggle around his feet without striking him; which among the nonpoisonous will not bite. He actually feeds some of his rattlers by hand. Well may he know them, for he has captured untold thousands of snakes during his long career.

His greatest series of collecting trips took him into Colorado first in 1930, and during five expeditions he captured, with Mrs. Perkins's help, 909 snakes, nearly all prairie rattlers, with a sprinkling of bull (gopher) snakes and harmless hog-noses (spreading adders). In a single day he

stuffed ninety-nine rattlers into bags to be shipped to the San Diego zoo.

On his expeditions, Perkins first finds "snake territory," then proceeds to clean the reptiles out in wholesale numbers. In Colorado, for instance, he went out from Platteville and located three prairie-dog towns. Following the contour of the slopes, much as a trout fisherman drops his bait along the break in a lake, he picked up snakes with the greatest of ease.

He hunts, usually, when the snakes are emerging from hibernation, and again when they are ready to go to sleep for the winter. Around Platteville, he searched the prairie-dog towns in April and October, when the nights were cold. The snakes, he discovered, would emerge from the earth promptly at ten o'clock in the morning, and begin to disappear at two in the afternoon, after having sunned themselves four hours.

He and Mrs. Perkins walked through the prairie-dog towns, pulling the rattlers out of their holes and chasing them across the countryside. As usual, he found many odd beliefs among the local people, and was able to dispel more than one error about snakes.

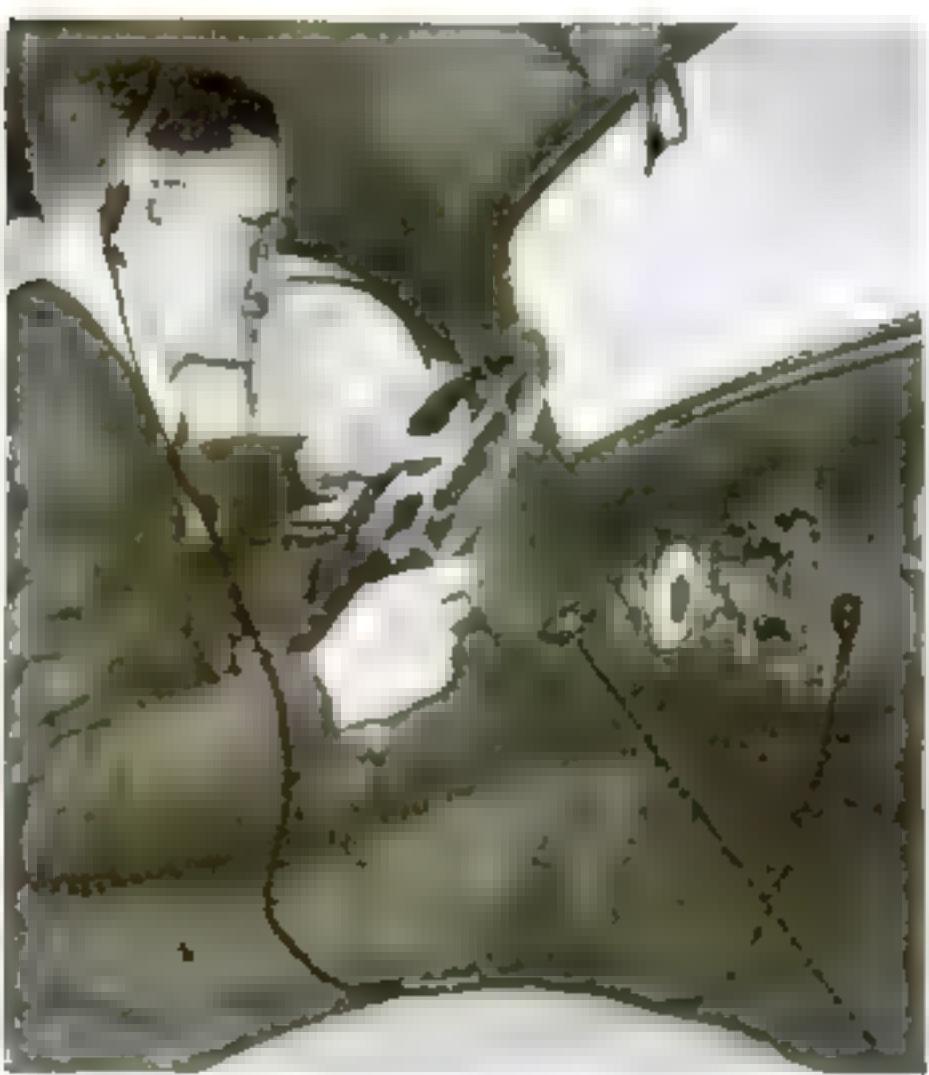
Perkins employs two methods to catch snakes. Some he captures by slipping a flat leather noose, fitted to the end of a stick, over their heads. Others he takes by slipping a (*Continued on page 113*)

GIANT SWITCHBOARD CONTROLS LIGHTS ON LONGEST BRIDGE

LIGHTS along the entire eight-mile length of the new San Francisco-Oakland Bay Bridge will be operated from one giant control board. Ground plan and elevation of the huge span are drawn on the control panel, as are lines running from each switch to the exact section of the bridge which it controls. Lines of different colors indicate circuits controlling fog signals, navigation lighting, and roadway illumination. Six hundred tiny lamps on the board indicate the location and condition of pieces of electrical equipment.

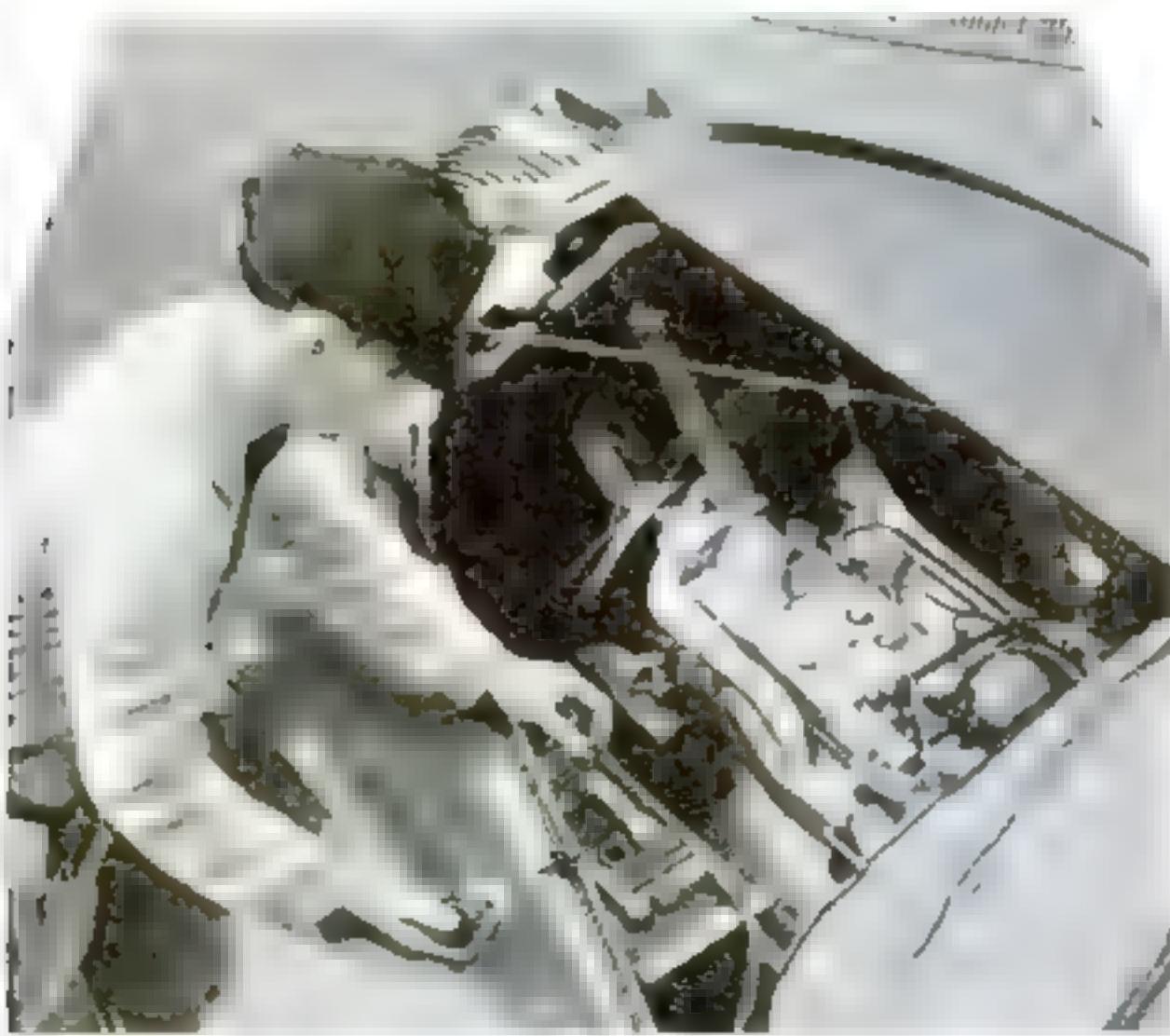


Electrical control board of the San Francisco-Oakland Bay Bridge. Ground plan and elevation are drawn on the panel



"SILENT" AUTO RADIO USES DEAFNESS AID

A NEW YORK inventor has wired his car radio so that he can cut out the loudspeaker and still hear programs without disturbing other passengers. Connected to an outlet on the dashboard is a bone-conduction-type hearing aid. Worn back of the ear, the device does not prevent the driver from hearing horns and other signals.



In this novel location, the car's battery is easily accessible

ELECTRIC APPARATUS REVEALS HOW PEOPLE WALK

USING unique recording apparatus, British scientists are conducting walking tests to study the human gait. Wired to the hip and heels of a subject who walks along a metal carpet on metal-soled sandals, an automatic electric device records each sway of the hips and each contact of soles and carpet. Another method used to record the pace and timing of a walking subject is to photograph him as he strides on an elevated treadmill, as shown at the right. Information obtained from the tests may prove useful to shoe manufacturers in designing footwear on scientific principles for comfortable wear.



As the subject walks on a treadmill, a camera records his pace and timing

Right, electric apparatus worn on hips and heels for analyzing gait

CAR BATTERY IS UNDER HOOD

TO MAKE it easier to service and change, the battery in a new 1937-model automobile is placed under the hood near the engine instead of beneath the front-seat floor boards. The new location is not only more accessible, but is also said to result in increased starting efficiency due to shorter leads between battery and starting switch. Cold air coming through the radiator grille passes through holes and louvers in the battery's case to counteract excessive heat from the engine.

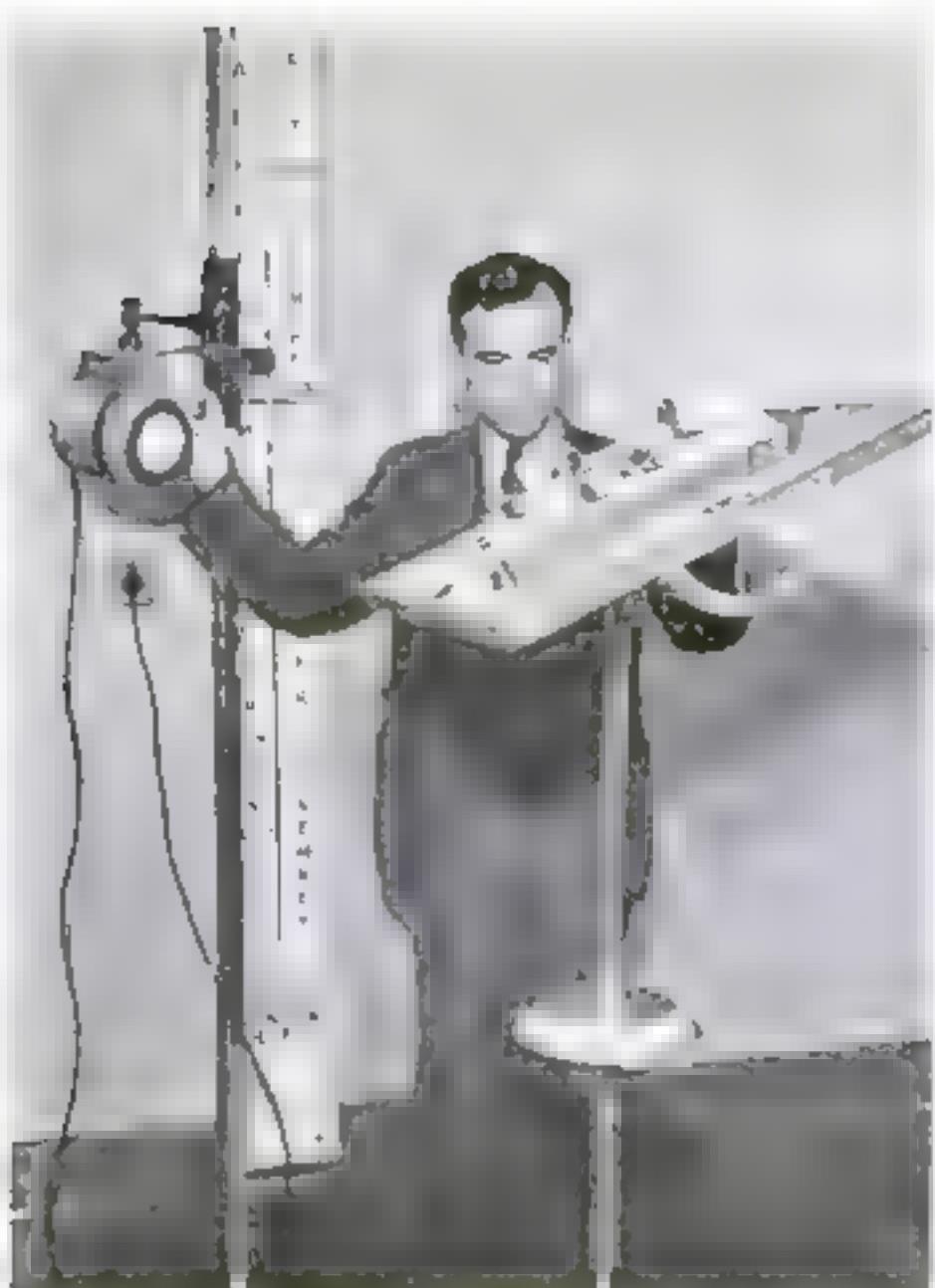


Worn on the collar, this device keeps a sleepy driver awake

CHIN ALARM RINGS WHEN DRIVER NODS

AUTO accidents caused by motorists who fall asleep on long drives may be prevented by a new "chin alarm." Attached to the driver's collar, the spring-operated device sounds an alarm whenever the operator begins to nod, bringing his chin into contact with a small trigger at the top. Airplane pilots, motormen, and others could also use the odd alarm.

AMPHIBIAN LIFEBOAT SPEEDS RESCUES



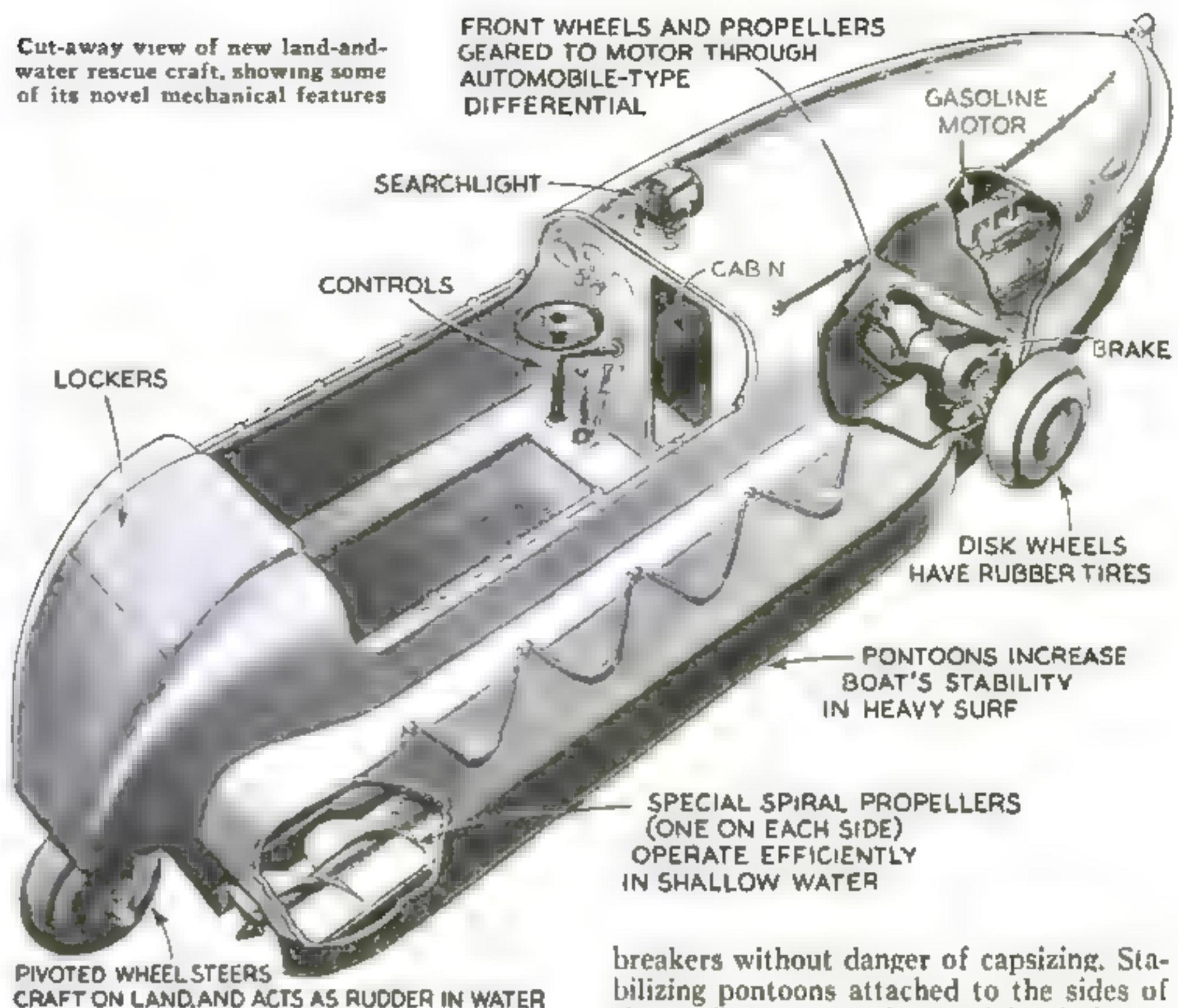
ARTIFICIAL SUN AIDS IN HOUSE PLANNING

AN ARTIFICIAL SUN, set up at the Columbia University School of Architecture in New York City, enables architects to plan and landscape houses so that they will have the maximum of sun in winter and the maximum shade in summer. A spotlight, representing the sun, can be adjusted up or down on a vertical support to simulate the apparent changes in the sun's position during the year. Rays from the light are focused on a small platform bearing a model of the house being studied. When this platform is tilted so that its position in relation to the "sun" corresponds to its latitude (see page 52), it is revolved slowly and the amount of "sunlight" striking the house gauged for every hour of the day.

GOLF MAY BE TAUGHT BY TELEVISION

GOLF ENTHUSIASTS may soon learn the fine points of the game by means of television. During recent experiments with outdoor television transmission, British experts trained their scanning apparatus on Archie Compston, famous English player,

Cut-away view of new land-and-water rescue craft, showing some of its novel mechanical features



POWERED by a gasoline engine that drives both wheels and propellers, an amphibian lifeboat just invented is designed for offshore rescue work in heavy surf. Kept on shore, the three-wheeled craft can be driven over the sand and quickly launched into the waves, its flat-bottomed hull enabling it to navigate broadside in the surf and skid over the

breakers without danger of capsizing. Stabilizing pontoons attached to the sides of the surfboat cover the special spiral propellers, which are placed flush with the hull bottom to allow the amphibian to operate in shallow water. Steering on land is accomplished by a single pivoted rear wheel, which serves as a rudder when the odd craft is afloat. The pontoons may be used to house extra fuel tanks on extended cruises, or they may be removed, together with the wheels, if it is desired to operate the amphibian solely as a motor boat.



Archie Compston, British golfer, demonstrating strokes before television scanning apparatus



APPARATUS GRADES MILK ACCORDING TO COLOR

GRADING of milk according to color was demonstrated at a recent convention of dealers, by the use of an instrument known as a colorimeter. A specimen of milk is placed in the apparatus and a beam of light is passed through it; the amount of light transmitted is then carefully measured, for it is known that highly-colored milk transmits less light than milk of low pigmentation. Tests are being made in an effort to breed cows that will give milk of a standard yellow color.



PORABLE MAKE-UP KIT HAS LIGHTED MIRROR

COMPACTLY stored in a small suit case, a new theatrical make-up kit includes a mirror illuminated by two neon lamps. The mirror, flanked by the neon tubes, is fastened to the inside lid of the kit. When opened and connected to an electric outlet, the portable unit provides a lighted dressing table handy for amateur actors and especially for professionals on tour with traveling theatrical companies.

ELECTRIC EYE AIDS STUDY OF ENZYMES

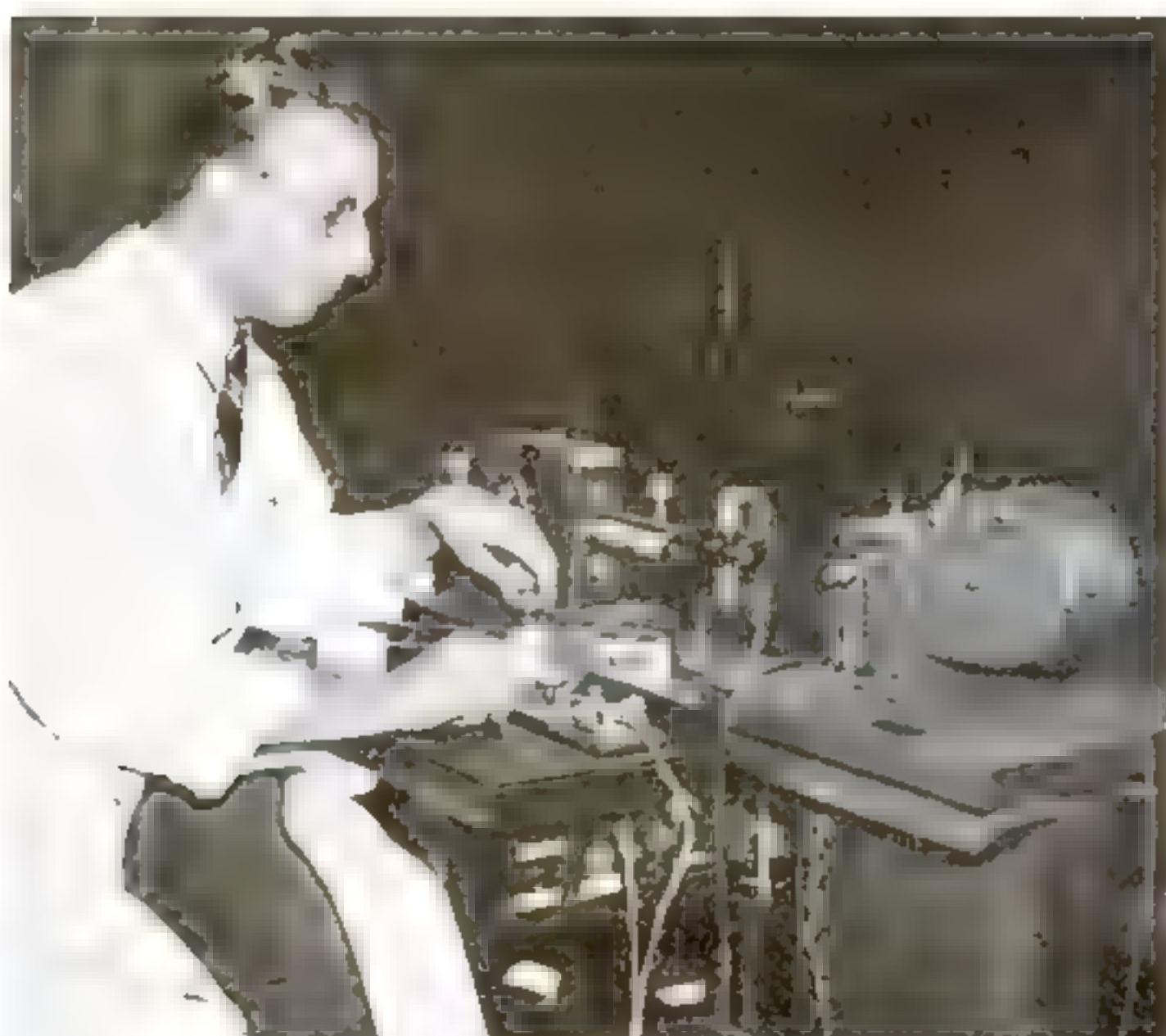


Photo-electric apparatus which reveals rôle of enzymes in fermentation

ODDEXERCISING TABLE MASSAGES MUSCLES

STOMACH and back muscles are said to be strengthened by a novel exercising table invented by a California physician. The subject lies prone on a flexible mat stretched across a padded roller which protrudes through a recess in the table top. Actuated by a motor-operated worm gear, the top slides back and forth so that the subject's muscles are gently massaged and exercised by the roller. The roller is adjustable for height, and the sweep of the moving table top also is subject to control.

LIGHTWEIGHT TRACTOR GUIDES ITSELF

A NEW lightweight farm tractor recently demonstrated in England automatically guides itself even though its operator releases the controls, as shown in the illustration. When started, the two-wheeled machine draws a plow straight on the course

set for it; if it meets some obstruction, such as a large boulder, the tractor will automatically stop, thus preventing serious damage being done to the plow.



Tractor following course set while operator walks alongside



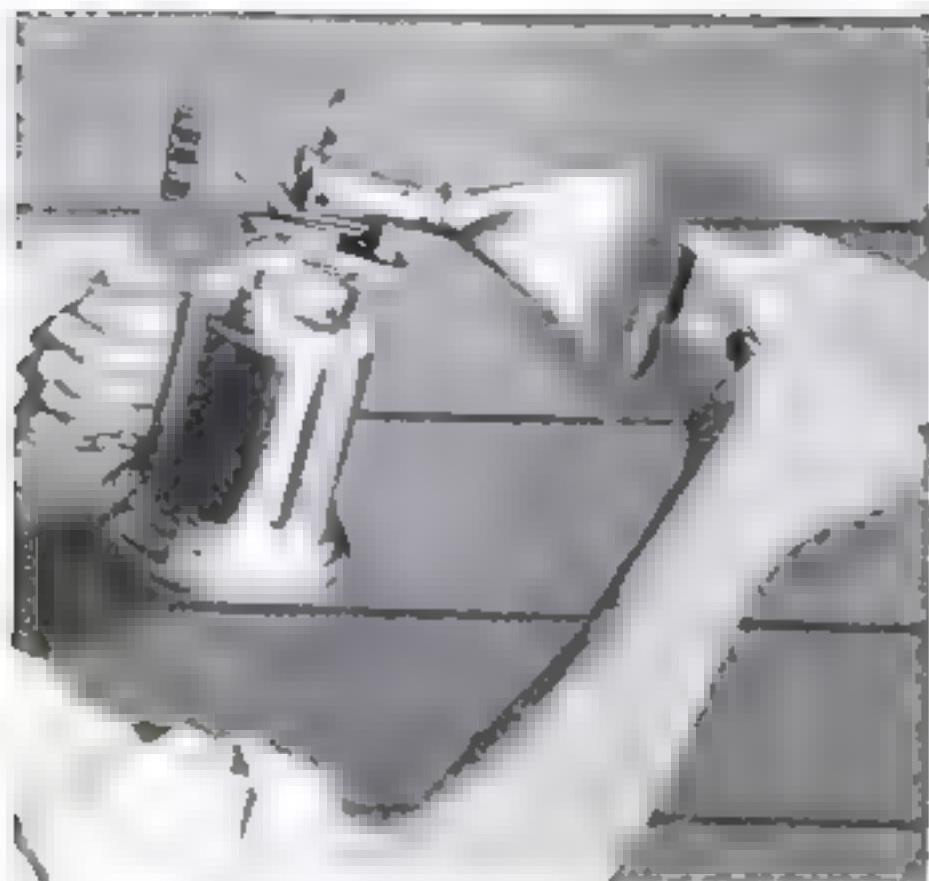
CLAMPS FOR FUSE CLIPS GIVE TIGHT CONNECTION

LOOSE CONNECTIONS between contact clips and the metal ends of high-voltage cartridge fuses often cause loss of power and burning out of fuses. To eliminate this danger, a new safety clamp fits over the blades of the fuse clip, as shown in the diagram above. When a small, insulated knob is turned, the jaws of the clamp tighten around the clip blades, thus aligning sprung or uneven clips and insuring a perfect connection with the fuse. The device takes an equally firm grip on all sizes of clips, and should prove particularly useful on heavily loaded electric lines where fuse replacement is frequent.



As the table top moves back and forth, a padded roller massages the muscles of the abdomen or back

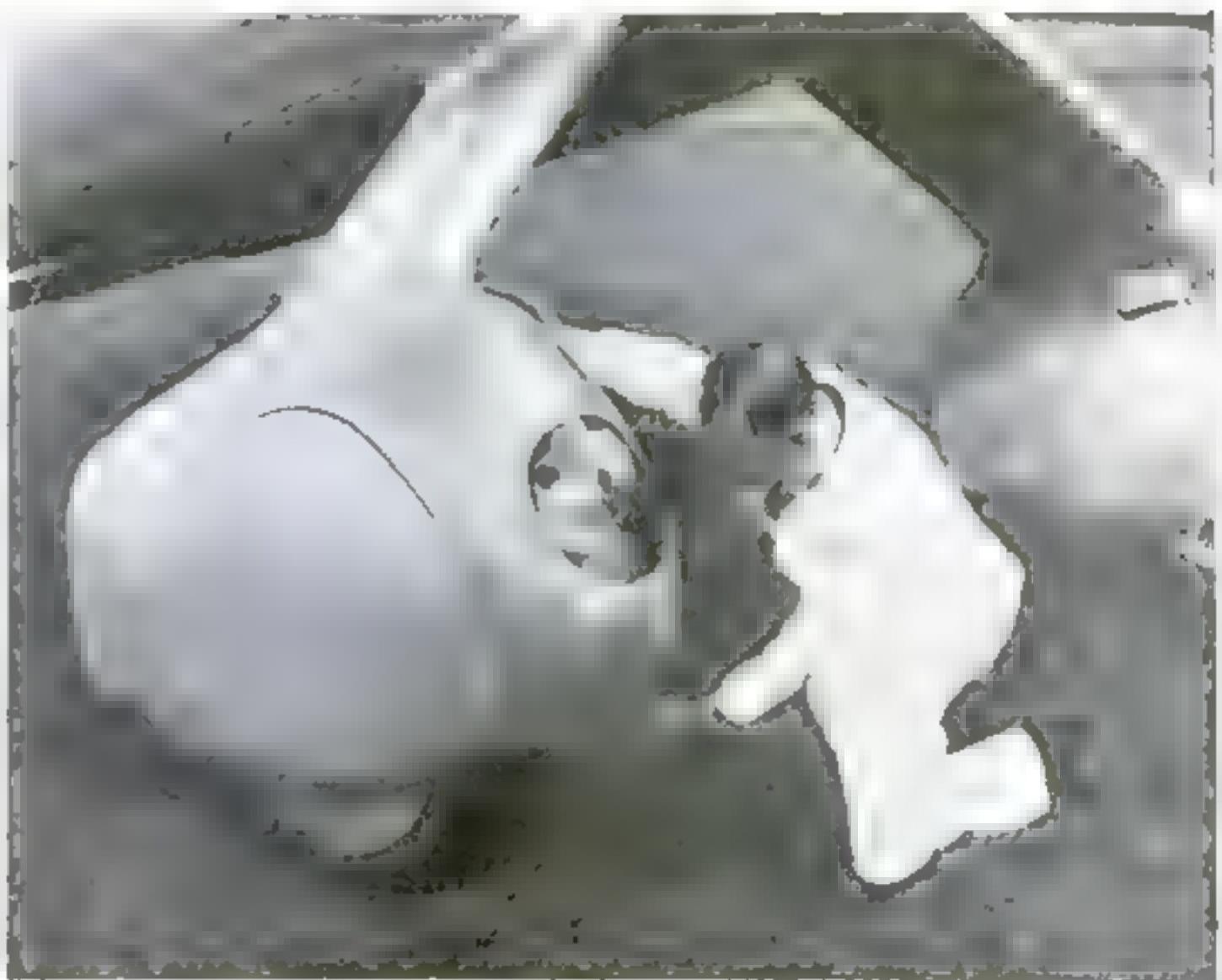
PLANE HAS LIGHTS ON LANDING GEAR



SPREADS TORCH FLAME

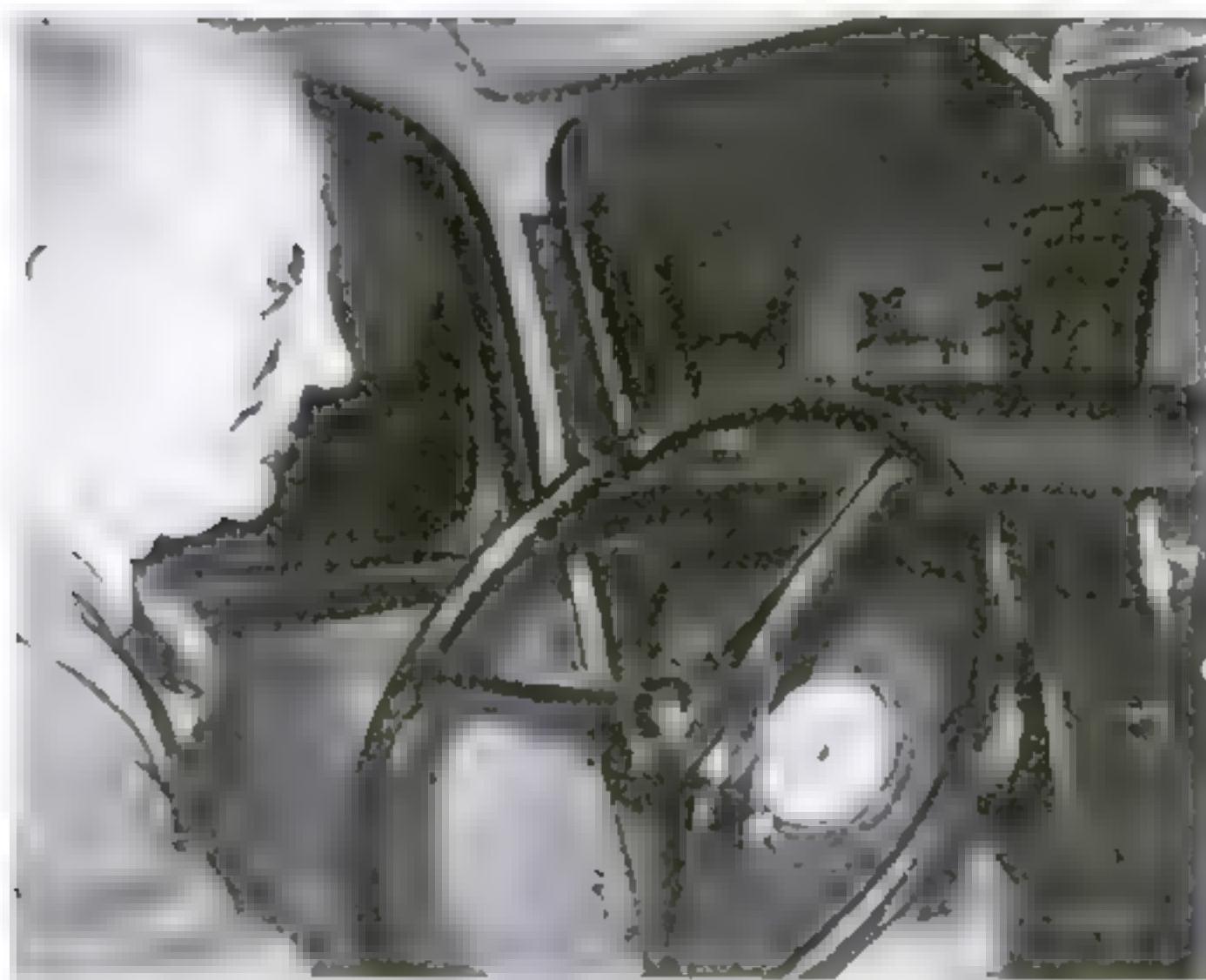
REMOVING paint with a blowtorch is made easier by a new flame-spreading attachment. Fastened to the torch nozzle with a set screw, the device flattens out the flame to four times its normal area. The spreader also is useful in other operations where a wide, flat flame is desirable.

TO CUT down air resistance and conserve space in the fuselage and wings, a new high-speed monoplane just completed for the British Royal Air Force has its landing lights mounted in the streamline wheel coverings. Curved lenses set flush with the housings protect the bulbs and reflectors. The lights cast their beams parallel to the ground, giving glareless illumination for take-offs and landings.



This built-in searchlight helps pilots in night take-offs and landings

MEASURES DISTANCE CAR RUNS IN FEET



Auto fitted with a new attachment which is connected to the speedometer, and measures the distance traveled in feet instead of miles

CONNECTED to the speedometer mechanism of an automobile, a new accessory now on the market measures the distance traveled in feet instead of in miles. The device has a calibrated dial which will register up to 100,000 feet, at which point it automatically returns to zero. The meter can be set and operated independently of the mileage recorder, and should prove especially useful to surveyors and other technicians desiring measurements in terms of feet.



Folding stilts, carried to the scene of a parade or sports event, allow a short person to see everything

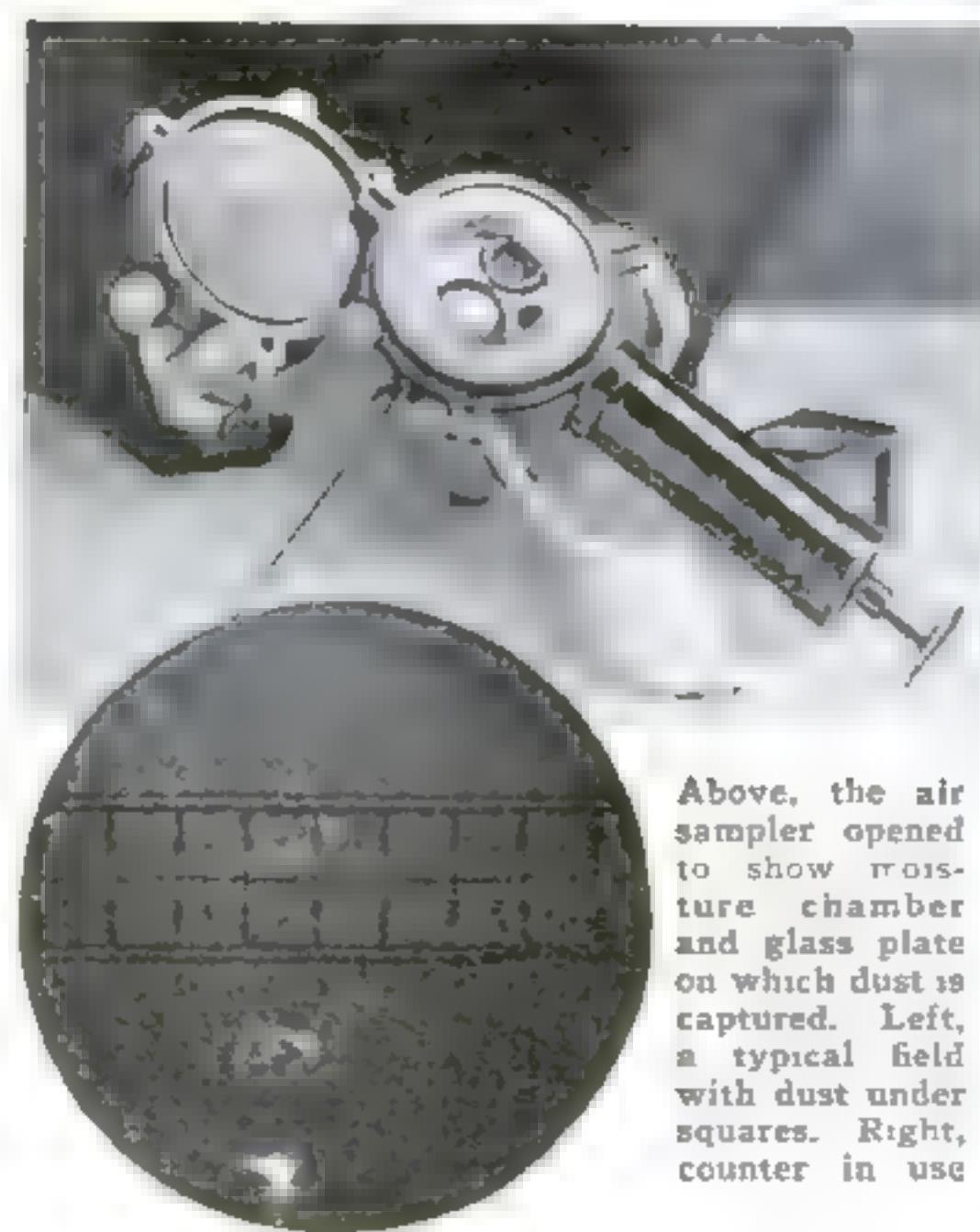
STILTS MAKE PORTABLE BLEACHERS

SHORT PERSONS in the rear of a group of spectators are aided by novel metal "stilts," shown below. Fitted with toe straps and made in hinged sections, the collapsible supports are folded into a compact unit for ease in carrying.



AIR SAMPLER AND MICROSCOPE UNIT REVEALS DUST PERIL

DANGEROUS amounts of dust in the air can easily be detected with a new dust-counting apparatus which combines an air sampler and a microscope in one unit. When air is drawn into the moistening chamber of the device by means of a bulb-type air pump, the dust present settles on a circular glass plate. The instrument is then placed over an illuminating box, and the dust examined with the microscope, which is equipped with a special eyepiece ruled off into accurately calibrated squares. The observer counts the number of dust particles within the squares and multiplies this figure by 100,000 to determine the dust count for one cubic foot of the air sampled. The unit will be used to keep an accurate check on dust concentration to prevent the contraction of lung diseases among workers in mines, quarries, tunnels, and industrial plants.

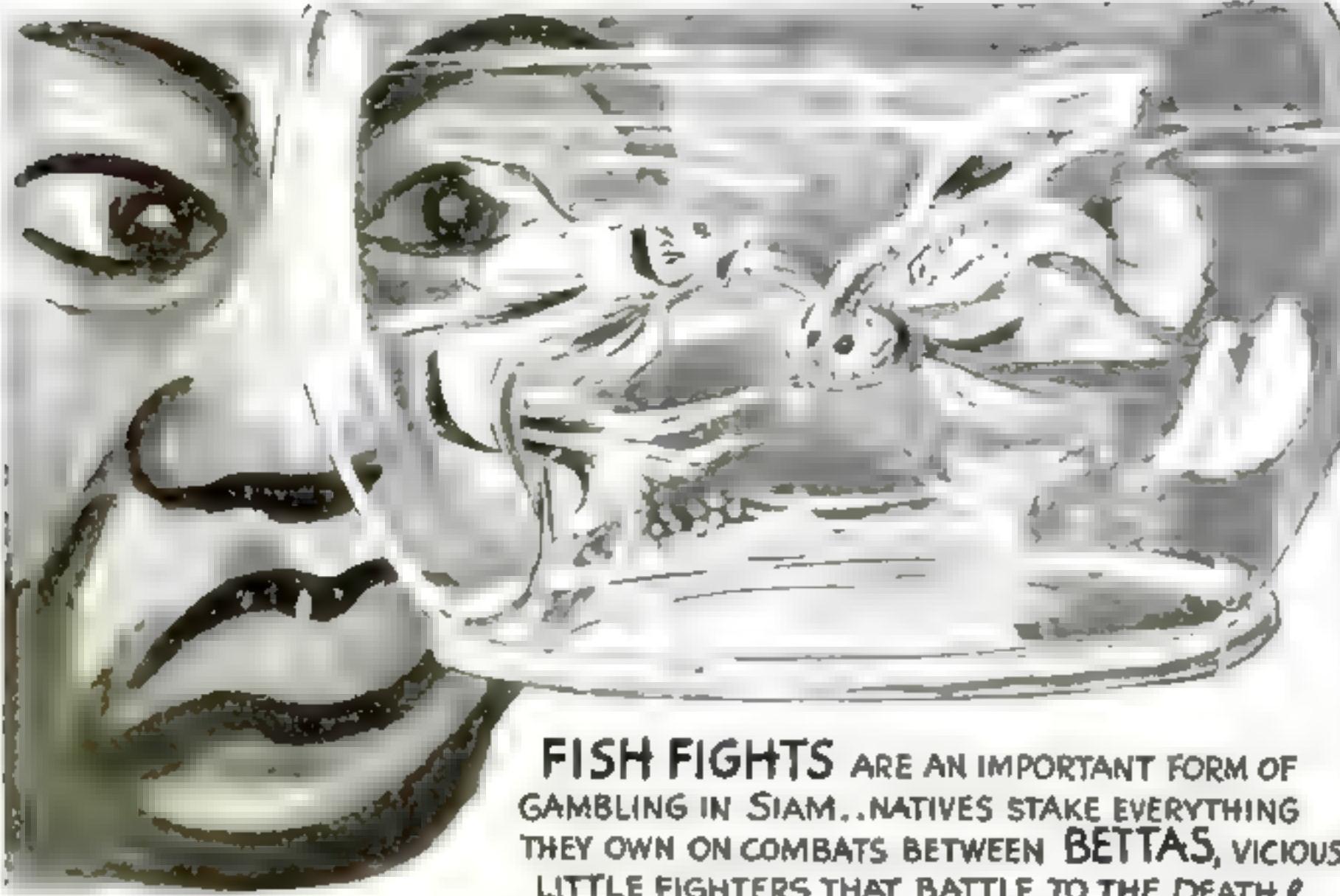


Above, the air sampler opened to show moisture chamber and glass plate on which dust is captured. Left, a typical field with dust under squares. Right, counter in use



Un-Natural History

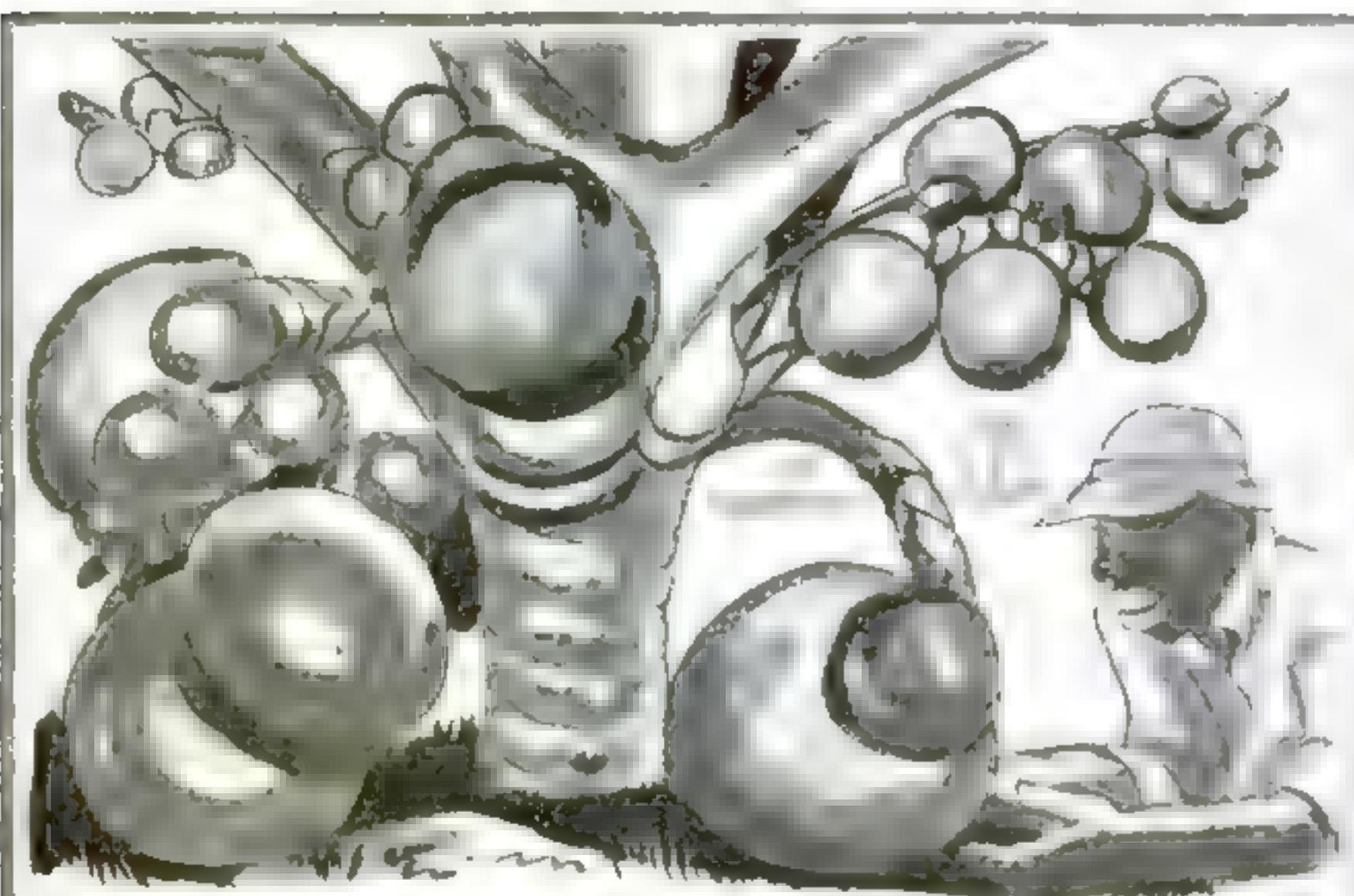
By GUS MAGER



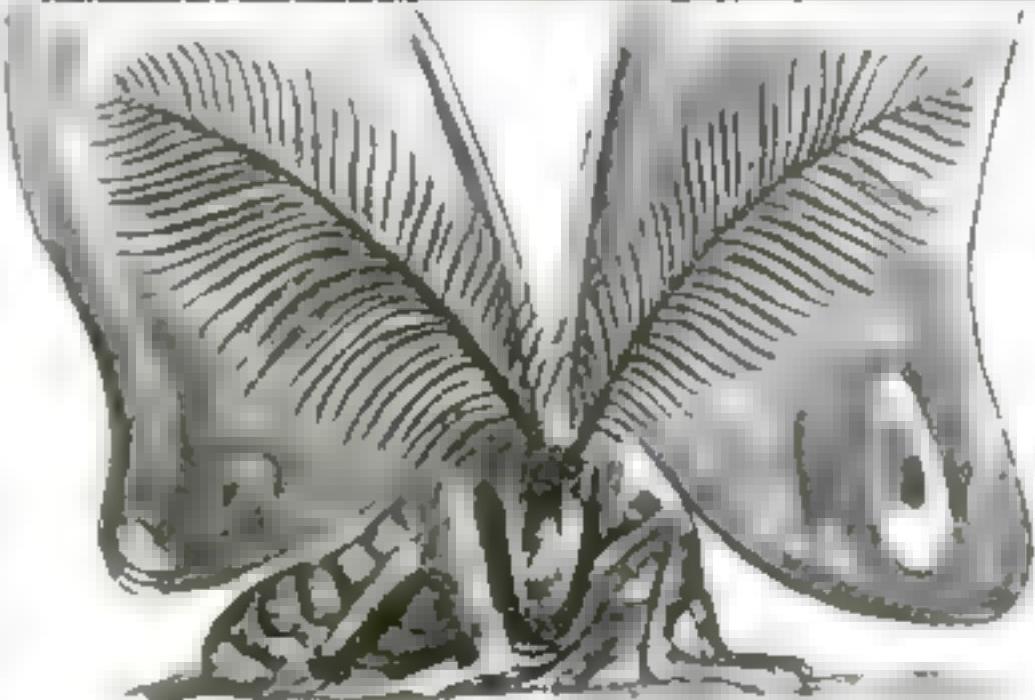
FISH FIGHTS ARE AN IMPORTANT FORM OF GAMBLING IN SIAM.. NATIVES STAKE EVERYTHING THEY OWN ON COMBATS BETWEEN BETTAS, VIOLENT LITTLE FIGHTERS THAT BATTLE TO THE DEATH!



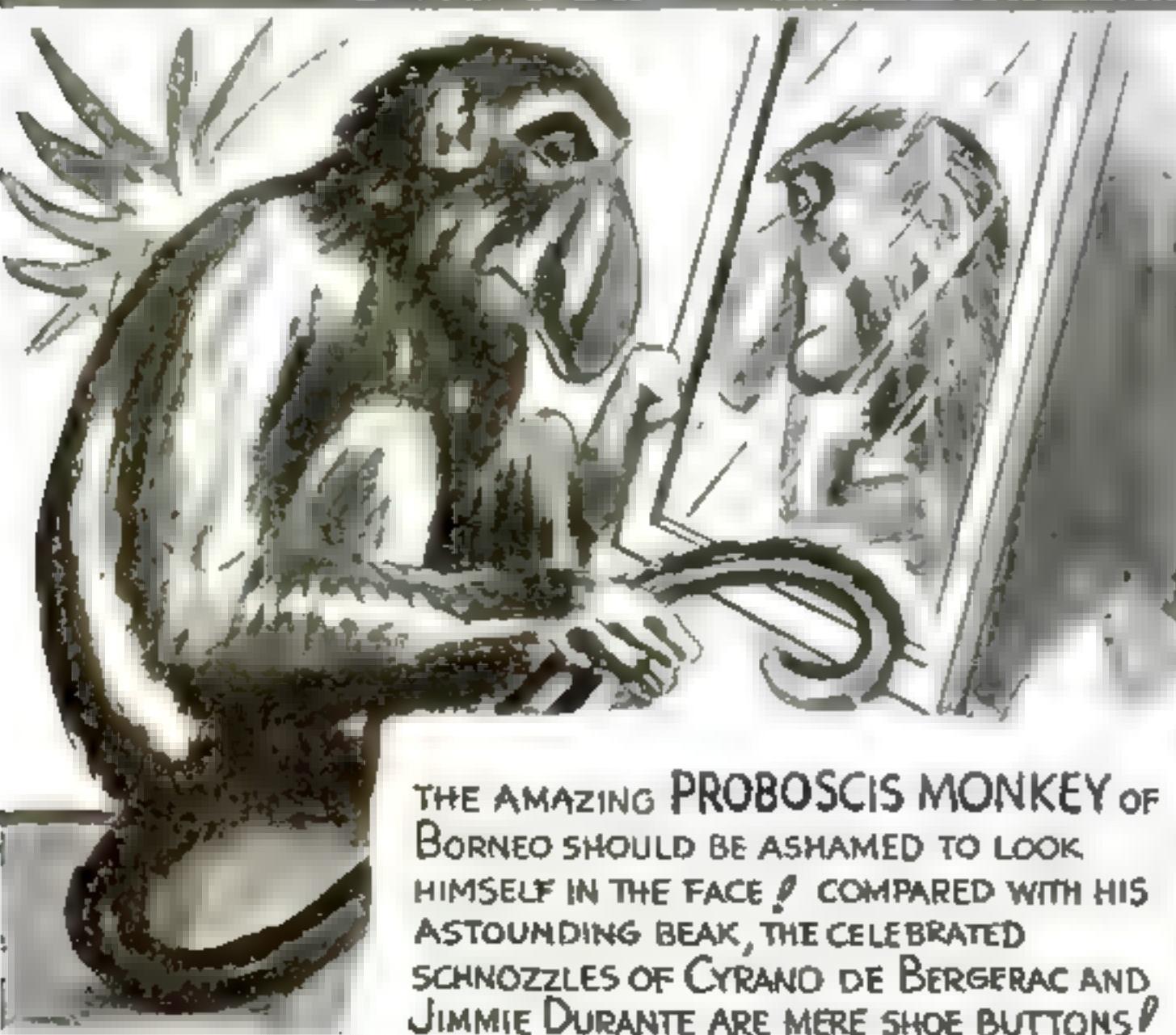
THE BEAUTIFUL FLOWERS OF THE YUCCA PLANT CANNOT FRUITIFY—PRODUCE SEEDS—WHERE THERE ARE NO YUCCA MOTHS! NOR DOES THE MOTH POLLINATE THE FLOWERS BY ACCIDENT. THE FEMALE MOTH DELIBERATELY COLLECTS THE POLLEN AND APPLIES IT TO THE STIGMA, MORE SKILLFULLY THAN IT COULD BE DONE BY A TRAINED HORTICULTURIST!



"DOUBLE COCONUTS," WEIGHING UP TO FORTY POUNDS, GROW ON THE ALMOST INCREDIBLE COCO-DE-MER PALM. FOR CENTURIES THE HUGE SEEDS DRIFTED ASHORE IN THE ORIENT, AND REMAINED A DEEP MYSTERY UNTIL THE DISCOVERY OF THE SEYCHELLES ISLANDS NORTHEAST OF MADAGASCAR, DISCLOSED THEIR SOURCE!



WIRELESS COMMUNICATION IS BELIEVED TO BE OLD STUFF TO MOTHS AND BUTTERFLIES. LOOK AT THE ANTENNAE OF THE CECROPIA MOTH (HERE GREATLY MAGNIFIED), THROUGH WHICH IT RECEIVES THE CALLS OF DISTANT MATES!



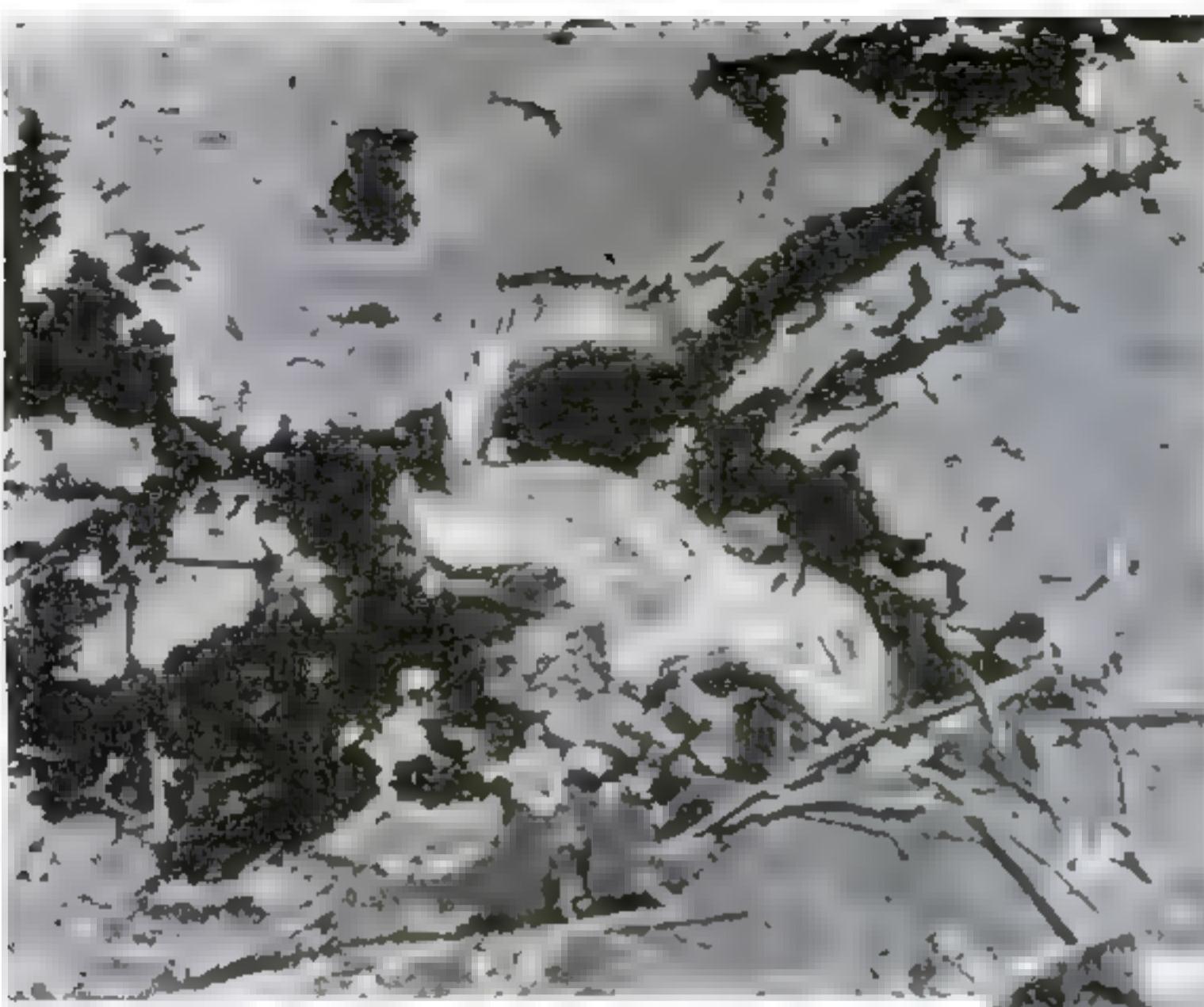
THE AMAZING PROBOSCIS MONKEY OF BORNEO SHOULD BE ASHAMED TO LOOK HIMSELF IN THE FACE! COMPARED WITH HIS ASTOUNDING BEAK, THE CELEBRATED SCHNOZZLES OF CYRANO DE BERGERAC AND JIMMIE DURANTE ARE MERE SHOE BUTTONS!



SPORTING A BODY SO COMPRESSED THAT, WHEN VIEWED FROM IN FRONT, IT IS REDUCED TO A MERE LINE, THE JOHN DORY SNEAKS UP ON SMALLER FISH AND EXTENDS HIS TELESCOPING MOUTH TO SWALLOW HIS UNSUSPECTING PREY! HE GETS ADDED EFFICIENCY FROM THE FACT THAT HIS EYES MOVE INDEPENDENTLY OF EACH OTHER, GIVING HIM A WIDE RANGE OF VISION!

World's Biggest Trap

YIELDS BONES OF
PREHISTORIC ANIMALS



A ground squirrel trapped in the black, tarry ooze of a strange pit near Los Angeles, Calif. Caught like an insect on fly paper, a victim sinks gradually into the depths of the mass

FROM the world's largest trap, a swamplike pit of black, tarry ooze not far from Los Angeles, Calif., scientists are unearthing the bones of strange animals that roamed the North American continent long before the dawn of recorded history. Called the "black springs," the deadly snare still traps unwary animals and birds to add to its buried collection of skulls, tusks, and vertebrae.

Formed thousands of years ago, the natural trap consists of large surface pools of a sticky viscous fluid that seeps up from an unknown underground source. Although the outer edges have hardened, the centers remain soft and treacherous. In dry weather, dirt and sand collects to conceal the tarlike swamp; in the rainy season, water hides the dangerous morass, making it appear as innocent as a rural mill pond.

Chickens, cats, dogs, and squirrels now stray into the pit just as their ancestors did centuries ago. There is no click, no snapping of powerful steel jaws, but suddenly the frightened victim finds itself held as fast as an insect on a sheet of fly paper. Its frantic struggles are futile, for gradually it sinks into the depths of the sticky mass.

Although excavations are still being

Reconstructed skeleton of one of the huge cats that roamed the California countryside before man came



A relic of a prehistoric battle: the skull of an ancient tiger with one of the long, saberlike tusks broken off. The stub had been worn by chewing food

carried on, more than 3,000,000 bones have been dug from the pit in the last thirty years—mute evidence of the huge toll of animal life taken by the deadly trap. Fortunately for science, the tarry ooze is an ideal medium for preserving bones. Even the tiny ear bones of animals, seldom found at other excavation sites, have been unearthed here in great numbers.

From the bones, scientists have reconstructed the skeletons of animals, some of which roamed the earth centuries before the appearance of man—cats four feet high, gigantic bears, mammoths larger than modern elephants, wolves of a species now extinct, and huge, giant-winged birds outstripping in size the condor, the largest flying bird that is alive today.

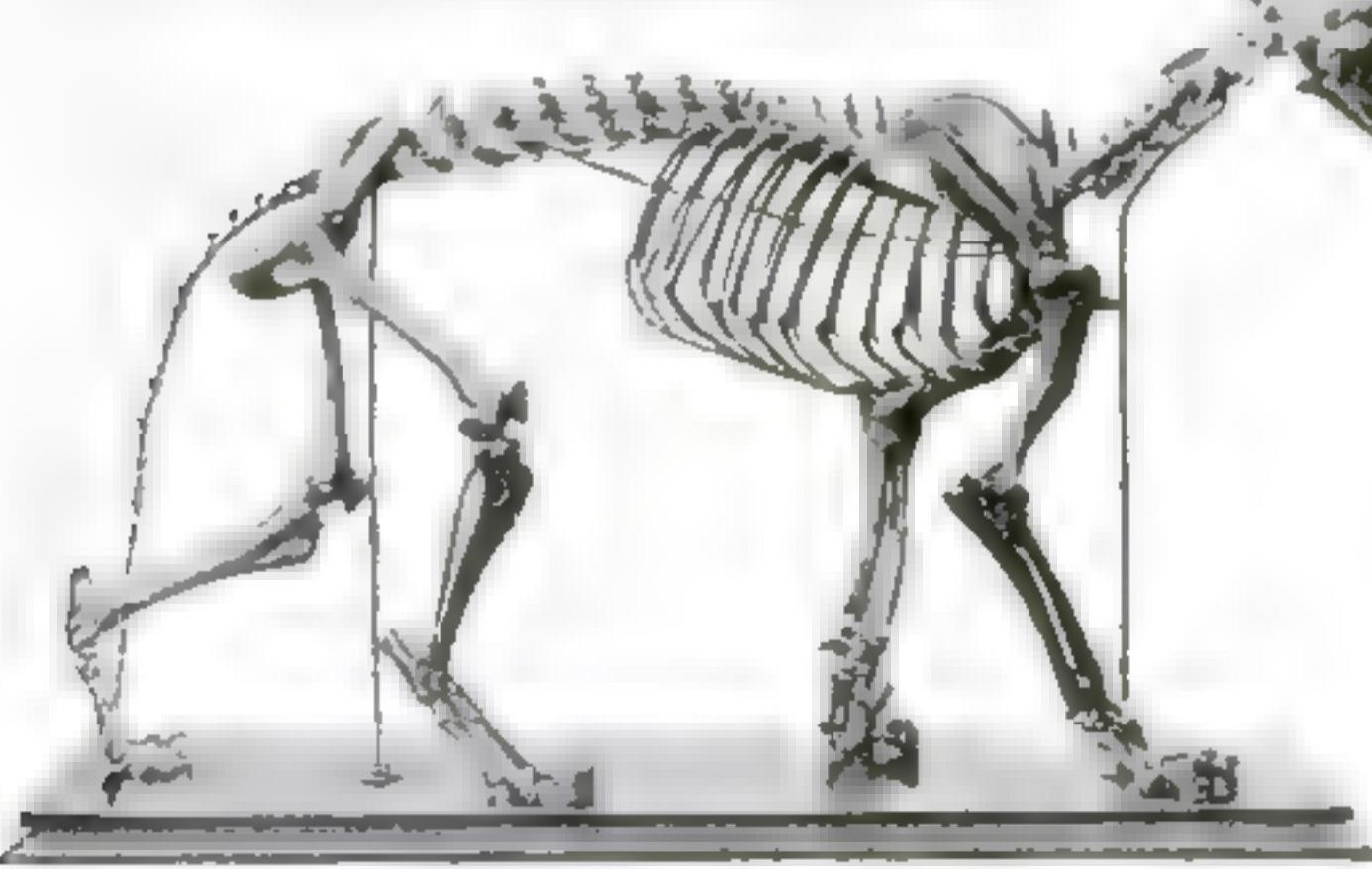
Some of the bones tell strange tales. Dr. John C. Merriam, president of the Carnegie Institution in Washington, D. C., discovered the skull of an ancient tiger whose long, saberlike tusks had been

snapped and shattered in some deadly fight. The stubs of the broken teeth were worn and blunt, indicating that the animal had continued to use them long after they had become useless as an offensive weapon.

No longer able to stab his prey with powerful thrusts of his giant head, the tiger had changed his hunting habits and the nature of his food. Probably it was this reason that led the old warrior to the trap he had avoided for so many years. Enticed by some helpless animal caught in the bog, the great beast had strayed too near the brink, and met his death.

Because of the warm climate, bodily tissues are not preserved as they are in the arctic, where the body of an ancient mammoth was recently found so perfectly refrigerated that the flesh could be eaten.

The great California trap has preserved an almost complete representation of life as it was lived in the days when the tarry pools were formed. By carefully digging, scientific workers are recovering the skeletons, assembling them, and placing them in museums to give a vivid record of the wild life that inhabited the prehistoric world before man appeared on the scene.



Turn the Microscope on



Holiday Evergreens Will Introduce You To the Important Family of Plants Called Gymnosperms, and Furnish the Materials For Countless Hours of Fascinating Study

By Morton C. Walling

SELECTING A SPECIMEN

Stems, leaves, and sometimes cones can be snipped off decorative evergreen shrubs, for use as specimen material for microscope examination



A young cone being sliced free-hand with a scalpel. A piece of soft wood makes a handy little chopping block



Here a yew leaf, held between the halves of a split carrot, is being sectioned with a razor. A little water is placed on the upper surface of the blade to float the sections



Left, dehydrating a small plant specimen with ethylene glycol mono-ethyl. This liquid, sold as a cleansing solvent, is used by some observers instead of alcohol

THE holiday season brings into the spotlight the Christmas tree; the Christmas tree suggests others of the so-called evergreens, and that brings us to a fascinating subject for our microscopes. For in the plant family that goes by the name of gymnosperm, and which includes the spruces, firs, and other trees so popular at yuletide, there is an endless array of material for the microscope hobbyist—material which, in most localities, is readily available at any time of the year.

The gymnosperm family of trees can claim distinction for being one of the most ancient. The coal you burn contains abundant evidence that pines and other members of the family flourished in prehistoric times when the coal beds were being formed from dying vegetation. The word "gymnosperm" means "naked seeds." That is, the seeds of trees in this family are not formed in a pod or other protective structure. The naked-seed family contains the spruce, hemlock, pine, cedar, fir, redwood, cypress, yew, tamarack, juniper, arbor vitæ, and other trees and plants commonly grouped together and called evergreens; and a number of plants which are not very commonly known, such as the tropical, fernlike cycads.

The common pine tree is probably the best-known member of the gymnosperm family, and it usually is employed as a specimen for studying the general characteristics of the group. You ought have no trouble obtaining adequate supplies of pine-tree or related material for microscopic examination. Even in your own parlor, at Christmas time, you can procure a few leaves (needles), some small branches, and perhaps a few cones; and almost anywhere you can pick up blocks of pine wood which can be converted into specimens revealing greater beauty than

you ever imagined could exist in a piece of wood.

Briefly, the life history of a pine tree is as follows: The plant you know as a tree is a sporophyte, whose job is to produce spores; and these spores are developed in structures known as sporophylls.

The sporophylls of the pine are specialized leaves collected into groups commonly known as cones. They appear in late spring. There are two kinds of them, as you will discover by examining a pine tree carefully. The staminate, or stamen-producing, cones composed of microsporophylls are the smaller. Each scalelike leaf contains two spore-producing chambers. These develop spores, or pollen, in such abundance that, in a pine forest, it may rain down like golden snow. The pine, being a primitive plant, depends largely upon vast numbers of spores to carry on its life chain.

The megasporophylls group together in larger cones; and it is these that most people recognize as pine cones. They are sometimes called carpellate cones. On the upper surface of each of the leaflike megasporophylls are two megaspores. Communicating with the interior of the structure containing the megaspores is a slender passage, the micropyle. When the golden spores from the microsporophylls fall on the megasporophylls, some of them enter the slender passage, where fertilization takes place.

Under the microscope, a grain of pollen from the pine tree reveals itself as a tiny

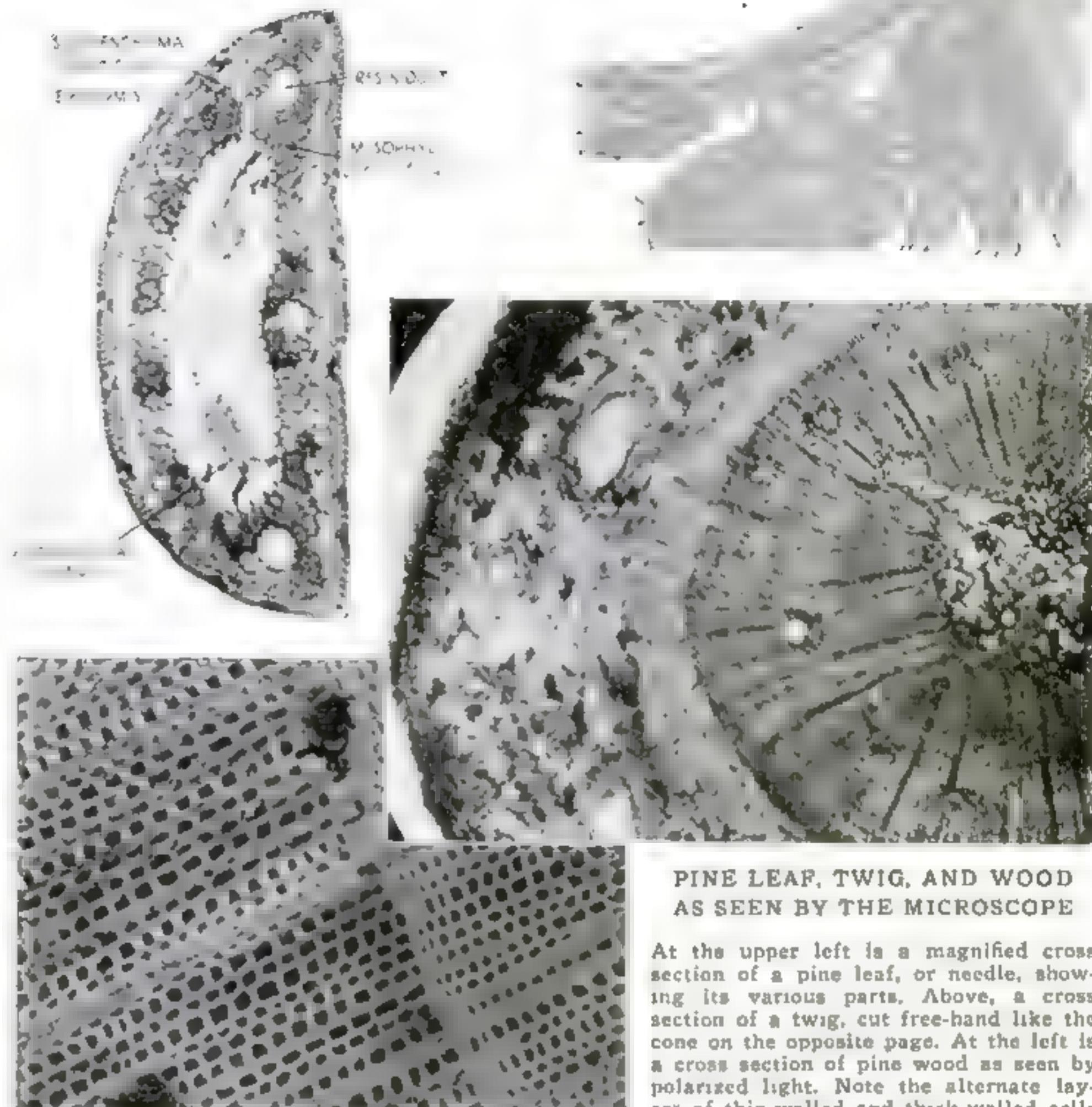
Your Christmas Tree

structure with two wings. The wings really are tiny air sacs that enable the pollen grain to travel long distances on the wind.

If you wish to make a permanent slide of some pollen grains, let them remain in a cardboard box, or in a bottle with a cloth stretched over its mouth, until dry. Then put the pollen into a small amount of turpentine in a test tube or vial. Several days may be required for the turpentine to replace the air in the grains. When this has been done, clean a cover glass, put a small amount of balsam in its center, and transfer the pollen to it after excess turpentine has been drained off. The pollen should be arranged in a thin layer. After the balsam has hardened on the cover glass, drop a little balsam in the center of a one by three-inch slide and, if necessary, warm it or add a trace of xylol to thin it; then carefully lower the cover glass carrying the pollen, balsam side down, on the slide. By gentle pressure, force out any air bubbles that you may have trapped. You can mount pine seeds in a similar manner.

The staminate and carpellate cones of the pine or other gymnosperms can be examined by splitting them down the center with a knife and examining at magnifications up to fifty diameters. Presence of much resin sometimes makes it difficult to do the splitting, but a bit of xylol will keep the blade lubricated. Remove a single scale or leaf from one of the smaller staminate cones, and examine it. Note the elongated pollen sacs on its lower surface. By opening these sacs when the pollen is about ripe, you can obtain supplies of grains. On the scales of the larger carpellate cones, you can observe the two ovules.

Leaves of gymnosperms resemble needles or scales. A good example of the needle-type leaf is provided by the pine, and of the overlapping-scale type, by the arbor vitæ used so widely as a decorative evergreen shrub. Leaves of gymnosperms are constructed to withstand dry soils and weather. That is largely the reason why pines are able to grow on hilltops, mountain sides, and other places where



PINE LEAF, TWIG, AND WOOD AS SEEN BY THE MICROSCOPE

At the upper left is a magnified cross section of a pine leaf, or needle, showing its various parts. Above, a cross section of a twig, cut free-hand like the cone on the opposite page. At the left is a cross section of pine wood as seen by polarized light. Note the alternate layers of thin-walled and thick-walled cells

there is relatively little moisture. Examine a cluster of pine needles. Note how slender and thick-bodied they are, how close they are together, and how they usually point upward where the sun will not strike them squarely. All these are precautions against too rapid loss of moisture.

In examining a whole pine needle at low power—twenty diameters or so—you will observe that it carries rows of glass-like spines along its edges, with their points turned toward the tip. You can feel these spines by pulling the leaf be-

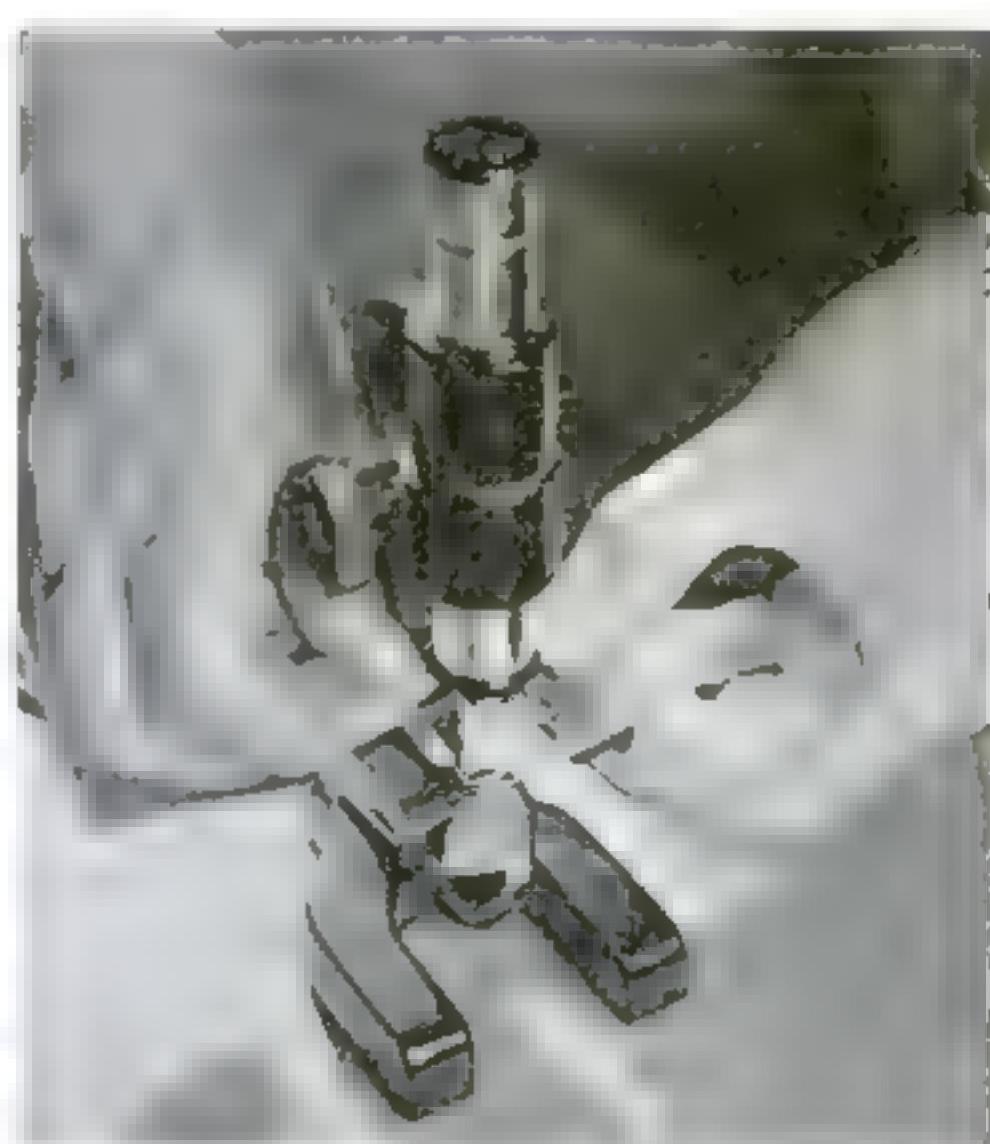
tween your fingers. You can see also the stomata, or breathing pores, in lengthwise grooves, this arrangement being a further provision against moisture loss.

Satisfactory sections of a pine needle can be cut free-hand by holding it between two pieces of elder pith, potato, apple, or carrot. Hold the blade of the razor—and it must be a perfectly sharp blade—in a horizontal position so you can draw it toward you, across the pine needle. Place a little water on the upper surface of the

(Continued on page 101)

Finding New Wonders in Shavings

The photographs below and at the right show how longitudinal sections of wood can be cut with a sharp block plane, clipped from the shavings in sizes to fit under the cover glass, and placed in the microscope. Such specimens may be examined dry. By adjusting the clips to press on the cover glass, as shown, you can hold the sections flat

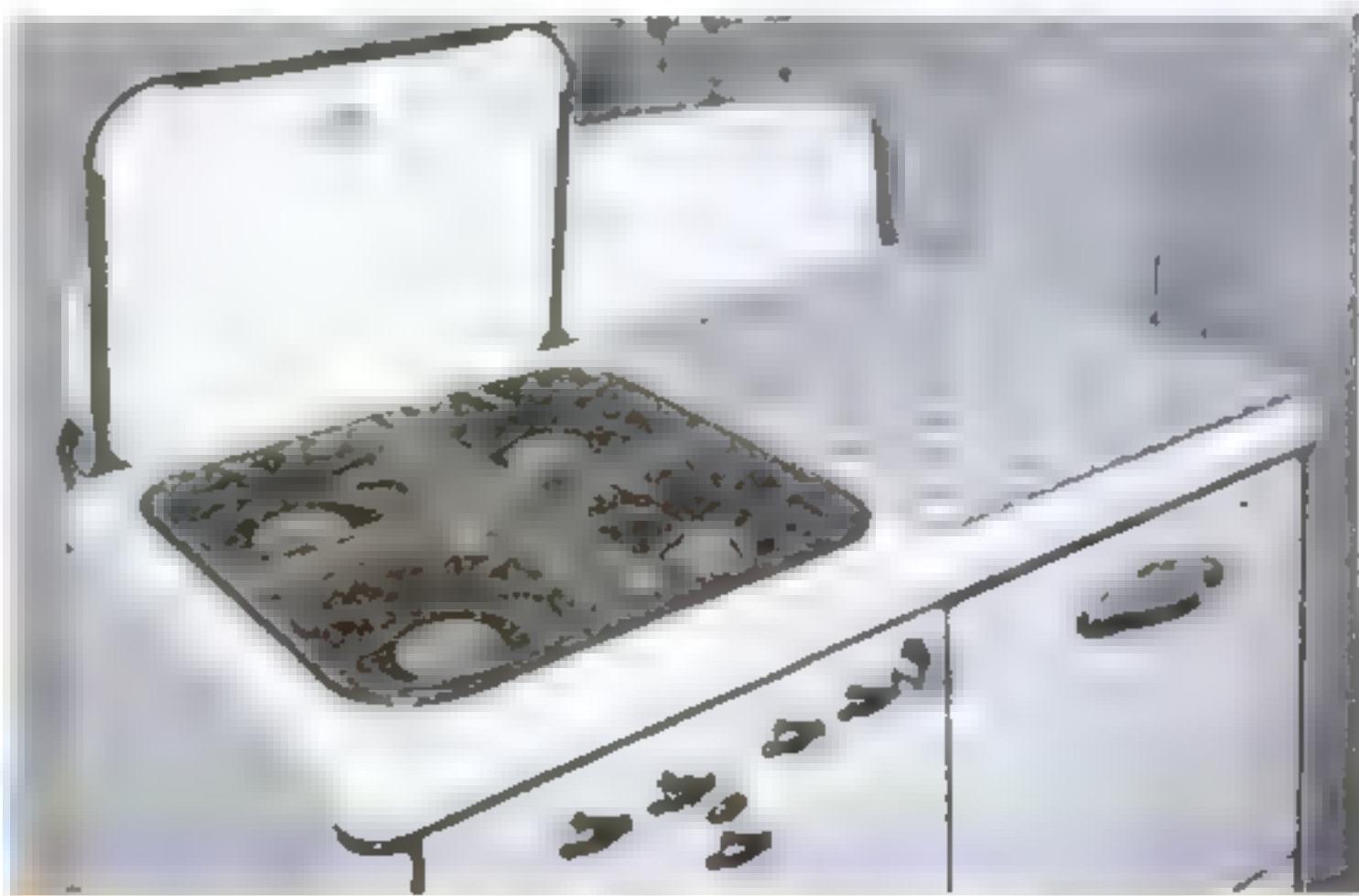




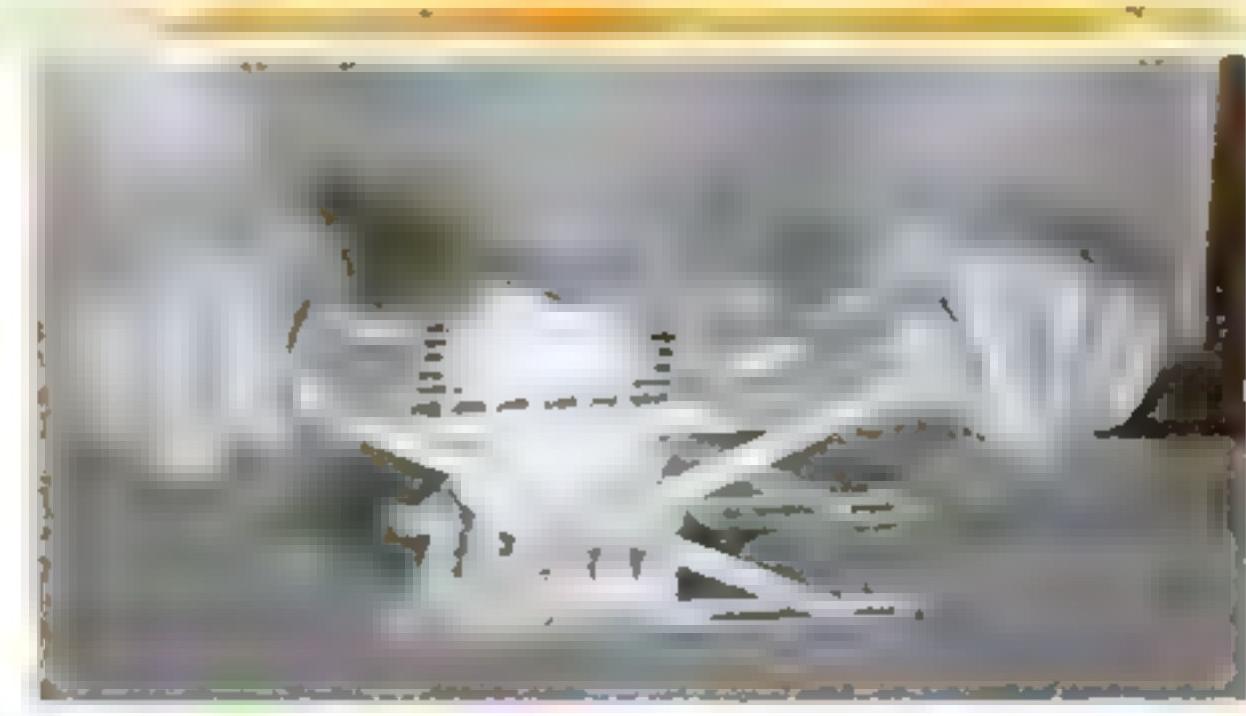
FASTENS SHADE TO TOP WINDOW SASH

With a new shade hanger that fastens to the top sash of the window, it is possible to have ventilation from the top without the usual nuisance of a flapping shade. The photo below shows how the novel hanger is attached

Latest Inventions FOR THE HOUSEHOLD



PADS PROTECT ENAMEL. Housewives can utilize the space on top of ranges and refrigerators without scratching the enamel surface, by using decorative pads now available in many colors and designs. Washable on top, they are backed with felt



POTATO DICER

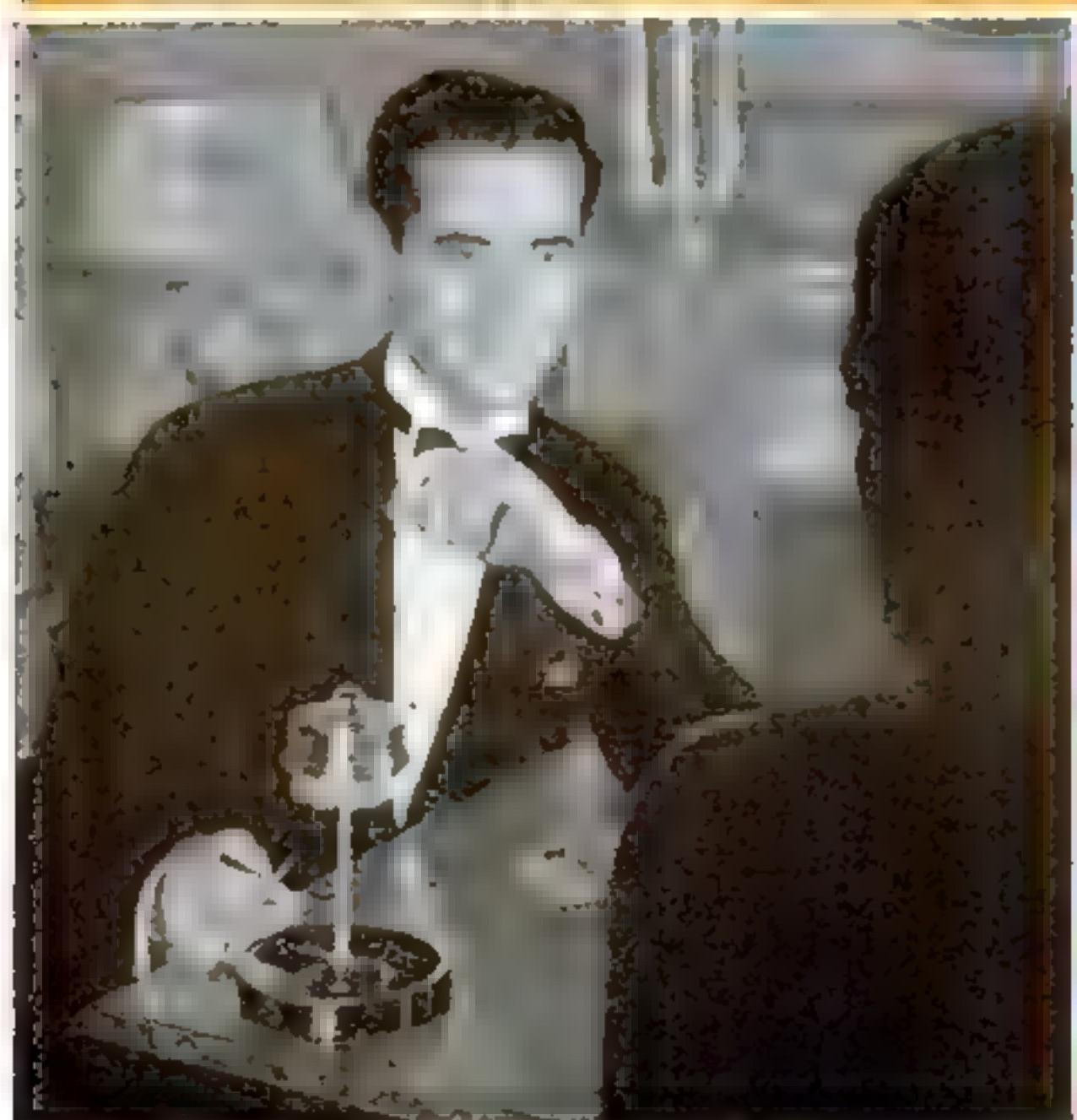
When a potato is placed in this ingenious device and the handles are pressed as shown, crisscross blades cut the vegetable into the long slivers required for French frying. The accessory also is useful for cutting up fruits for salads and other purposes

DUST MOP SHAKES ITSELF OUT
The dust mop illustrated below has a self-shaking feature that makes it easy to clean. A sliding handle near the upper end of the stick is attached by means of a cable to the hinged mop. When the handle is slid back and forth, the mop is rocked in a snapping motion that shakes out all the dirt



NOVEL STAND FOR MATCHES

The new pull-type matches, which are struck by yanking them out of their container, are accommodated in an attractive smoker's stand now on the market. The supply of matches can be replenished with handy refills



TEA STIRRER. The teapot shown at the right is fitted with a metal shaft that passes down through the lid and has a double-headed spoon, like a propeller, at its lower end. When the knob at the top is twirled, the spoon revolves and stirs the tea

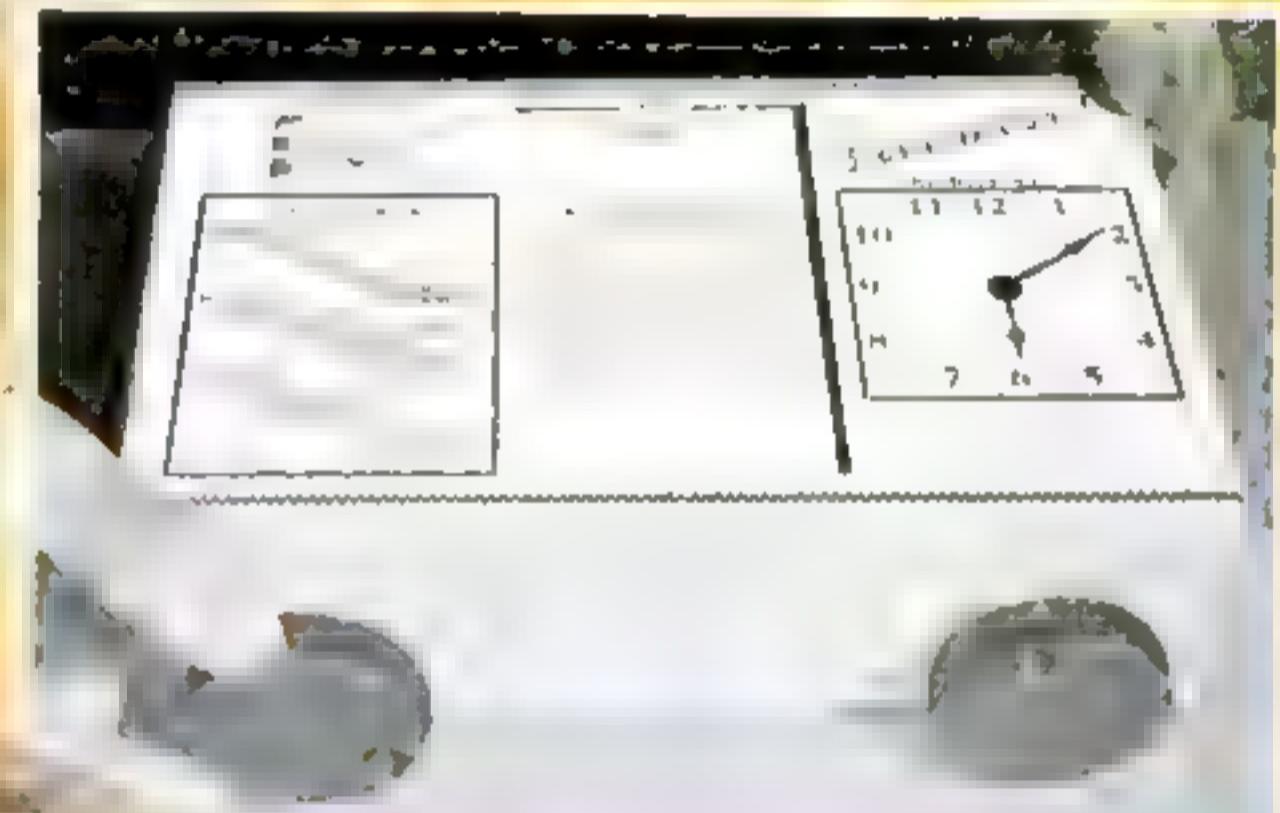


SALT SHAKER IS DAMP-RESISTANT
Because it has a top made of diatomaceous earth, which is very porous, the salt shaker at the left is said to remain unclogged in even the dampest weather. The top absorbs excess moisture



CAKE SERVER

Putting a piece of pie or cake on a plate is an easy operation with the knife shown below. A thumb lever pushes a sliding arm out over the blade, depositing the pastry neatly on the plate for serving



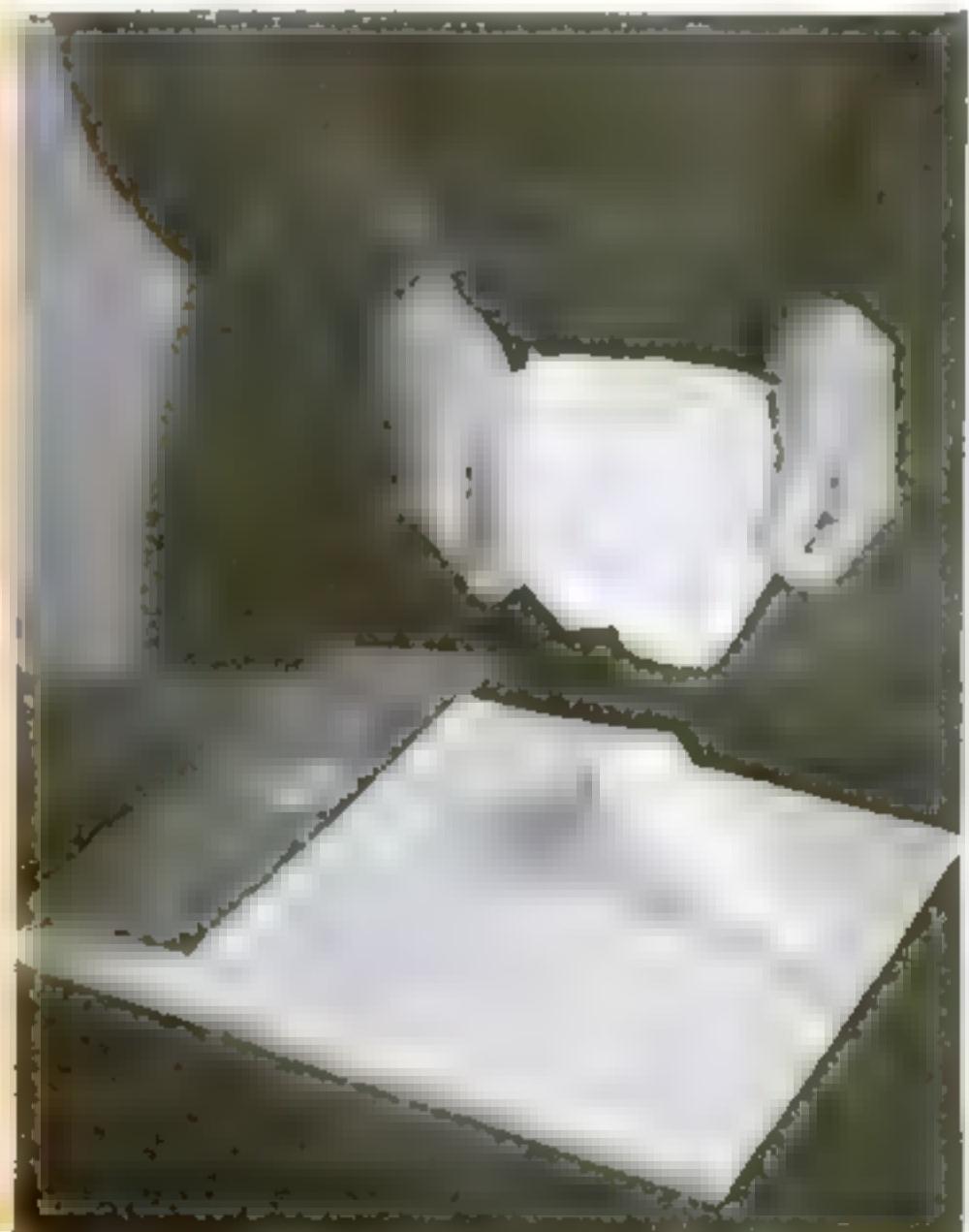
RECIPE REEL. Favorite recipes clipped or copied from newspapers and magazines are pasted onto a linen roll reeled on spools inside this holder. Knobs spin the roll



WINDOW-WASHING CHAIR. A comfortable, high-backed chair that is easily and securely fastened to the window ledge, permits the housewife to wash windows in safety. The device folds flat when not in use



COLD ROLLING PIN. Made of aluminum, this hollow rolling pin is filled with ice cubes for making pastry that calls for cold rolling. The metal construction makes it almost unbreakable



WASHABLE PAPER TOWELS. When they are soiled, the paper towels shown below can be washed and used over again. They are said to withstand several launderings without losing their soft texture

Back-Yard Navigation

...AN EASY WAY TO
FIND YOUR LATITUDE
AND LONGITUDE



A dummy posed to illustrate the method of finding latitude, or distance from the equator, with cord, nails, and a piece of cardboard

By GAYLORD JOHNSON

FEW people know the latitude and longitude of the spot where they live. Yet, with no instruments other than a watch, a few nails, a length of cord or wire, and an almanac, you can locate your house or back yard—just as a navigating officer on a ship or a plane establishes his position with the aid of a sextant and other apparatus.

This rough-and-ready method of finding your position on the face of the globe depends on an elementary principle of astronomy. Carried out carefully, it enables anyone to find his latitude, or north-and-south position on the earth, and his longitude, or east-and-west position, with a reasonable degree of accuracy.

First of all, exactly what is latitude? Glance at any globe or map of the world and run your finger along a "meridian" line from the equator to the pole. You will find it divided into nine equal parts, numbered by tens from zero to ninety. These figures indicate latitudes, or degrees north or south of the equator. Your first problem, then, is to find how many degrees your house is north of the line of the equator, if you live in the Northern Hemisphere, or south of the equator

if your home happens to lie in that section of the world.

Now examine the photodiagram reproduced here, and you will notice that finding your latitude simply amounts to measuring the number of degrees in an angle formed by two imaginary lines that pass through the earth's center. The first line is formed by the plane of the equator, and the second by a line dropped from your zenith, the point in the heavens directly above you, to the center of the earth. So, if you can set up a device which will enable you to create and measure this angle, you can determine your latitude.

To do this, find a tree with a small limb about six or eight feet above the ground. Cut this branch off close to the trunk, and drive a good-sized nail horizontally into the stub left on the tree. Now suspend a length of wire or cord from this nail and weight it down with a rock, flatiron, or other heavy object. When this wire comes to rest, you will have an improvised plumb line that points from your zenith to the earth's center and forms one side of a triangle which includes the angle you want.

Next, fasten a loose limb or large piece of wood to the base of the tree trunk so that you can nail the plumb line to it in an immovable position, as shown in the illustration. It is a good idea to have this vertical wire an even number of feet between the upper nail in the limb stub and the lower nail at the base of the tree. Six feet is a convenient distance, and is used in the illustrations.

Now take another length of wire or cord, twist a loop in one end, and hook it over the lower nail. This will form the second side of your triangle and should be considerably longer to start with than the plumb line.

You are then ready to find the third side, which will not be a length of wire but an imaginary line between the sun and your eye.

From a stiff piece of paper or a bit of cardboard, make a small sighting target pierced with a nail hole, as shown in the accompanying illustration. This slips over the second wire and slides up and down along it. In making the target, use a bit of photographic



"SHOOTING THE SUN"

Drawings above show how to make and use the cardboard sighting target. Right, how the sun appears through the peep hole when lined up correctly



Handy Aids for Radio Workers



Two ways of making use of soda straws in your radio workshop—
as a blower for cleaning receivers,
above; and as a small-part retriever
when used with a dab of wax stuck
on the end as shown in the circle

OF THE many odds and ends that come in handy when constructing radio equipment, few have more uses than a batch of ordinary soda straws. Made of heavy waxed paper, they provide a handy insulating material that can be slipped over bare connection wires when your supply of regular "spaghetti" tubing runs low. If no other means of protecting a temporary antenna lead-in is available, a soda straw slipped over the wire will insulate it from the window sill. Even small radio-frequency chokes can be wound on soda-straw cores to good advantage. They are



When your supply of "spaghetti" tubing runs low, wires can be insulated with short lengths cut from straws

just the right diameter and can be mounted easily by slipping them over match sticks cemented in holes in the circuit's baseboard. When dust clogs a tuning condenser in an old receiver, a soda straw used as



How a soda straw can be used to protect a temporary antenna lead-in. Made of waxed paper, it provides good insulation

a blow-pipe will do a fine cleaning job. Another handy tool, a retriever for small parts accidentally dropped into a crowded chassis, can be made by putting a dab of chewing gum or soft wax on the end of a straw. In experimental work, tiny condensers for neutralizing small capacities can be made from soda straws. Simply tie two straws together, side by side, with two lengths of thread and slip the wire from each side of the circuit into each straw from opposite ends. By pulling the wires out, or pushing them in, the amount of capacity can be easily varied. When the proper adjustment is obtained, a third piece of thread tied around the straws will serve to hold the wires firmly in place.

—L. B. ROBBINS.

NEW SOLDERING IRON IS DOUBLE-ENDDED

COMPLETE flexibility is featured in the latest soldering iron. Unique in construction, the new double-ended tool consists of a non-scaling soldering rod and a heating core mounted on a convenient handle. For jobs in out-of-the-way places, the soldering rod can be extended six inches, while a pivot mounting allows the heating body to be set at angles up to 110 degrees. Any one of three heats can be obtained simply by adjusting a rheostat built into the power cord. The heating unit, which is replaceable, is of the quick-heating type.

PLUG-IN CABLES SIMPLIFY BATTERY WIRING

COMBINATION power cables provided with convenient plugs now make it an easy matter to wire the necessary "A," "B," and "C" power-supply connections to battery-operated receivers. Designed for use with the latest types of plug-in



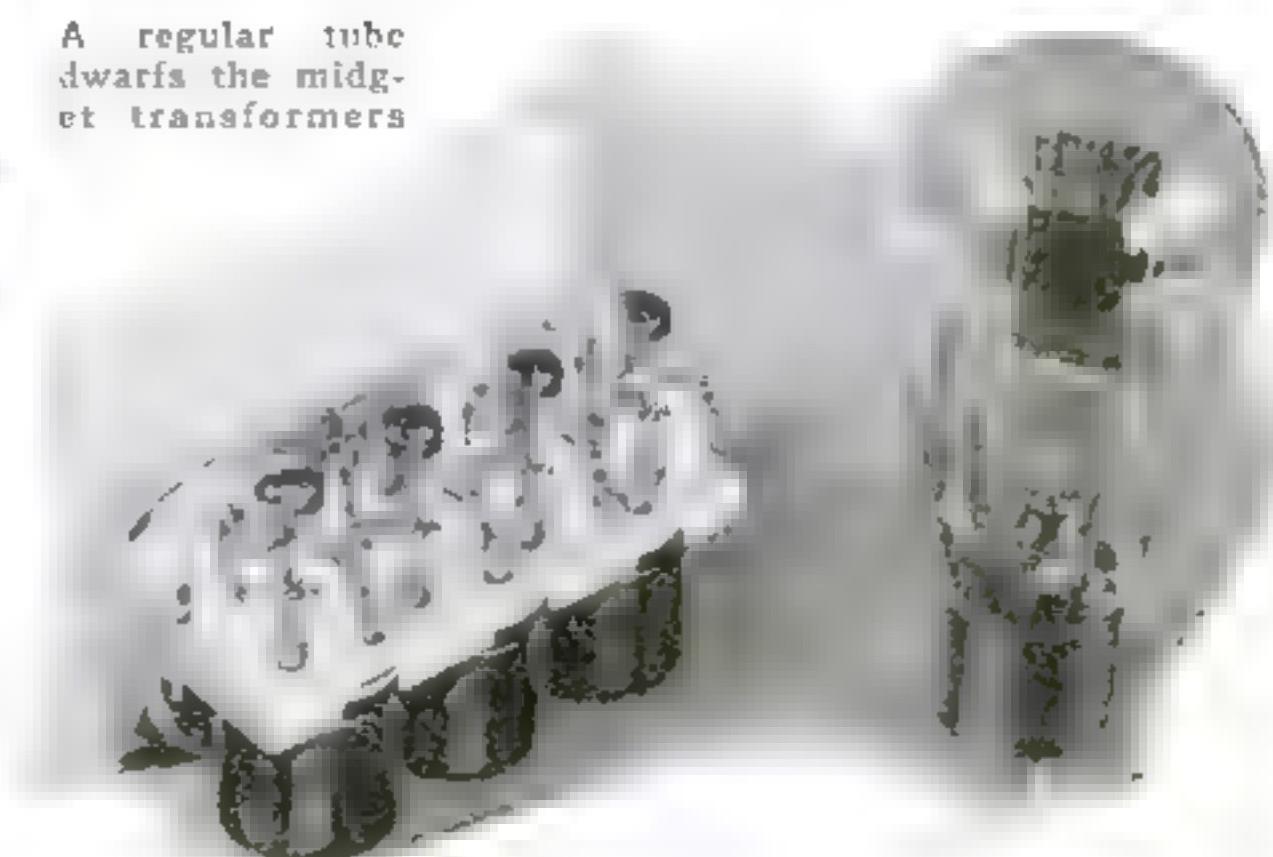
A pistol-grip handle makes this new soldering iron easy to use

batteries, the new cords are provided with one large seven-prong plug for connections to the receiver and three smaller three-prong plugs for the battery units.

TRANSFORMERS FOR MIDGET SETS

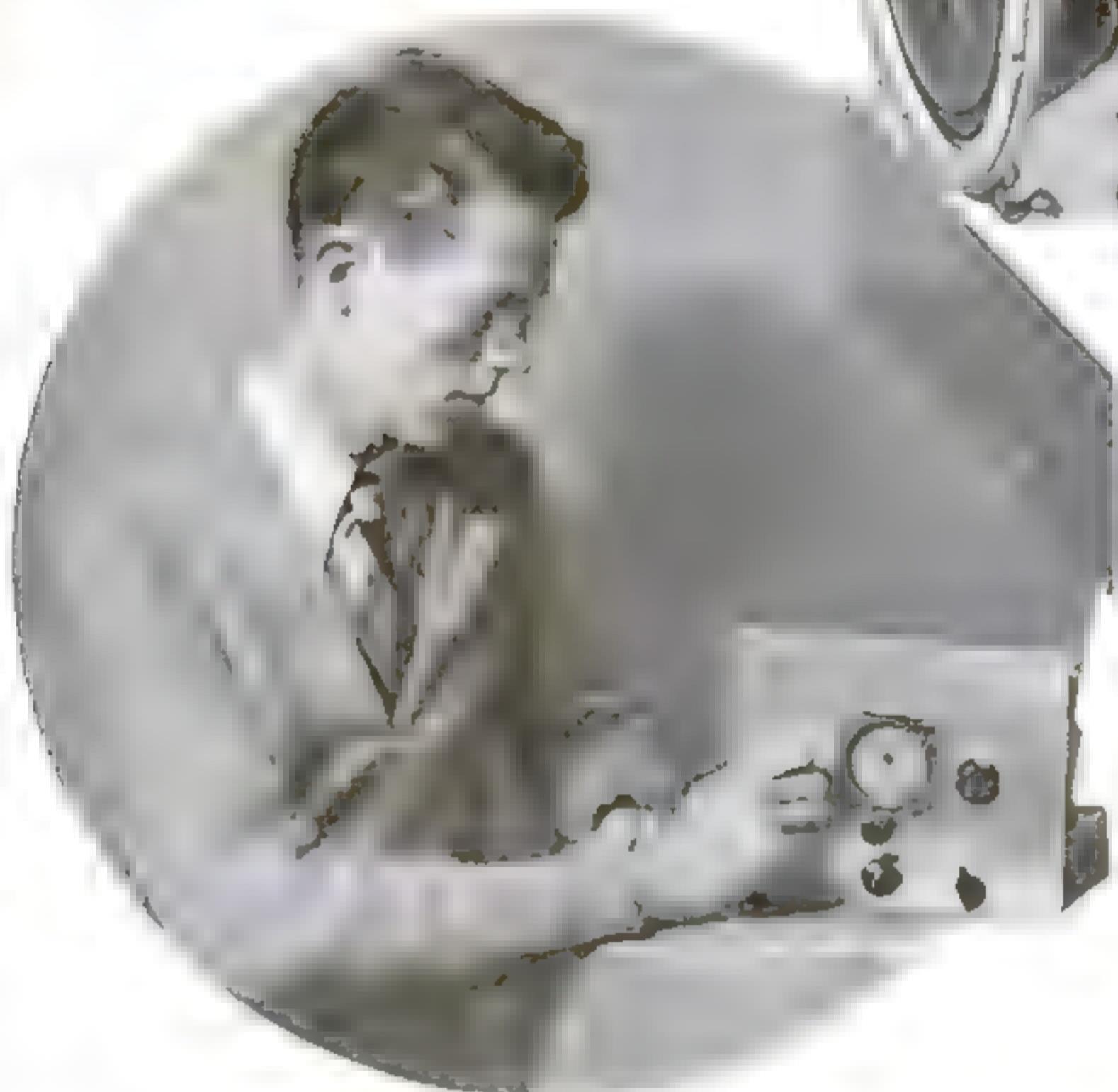
RADIO experimenters who build midget receivers will find many uses for the tiny audio transformers now on the market. Housed in cylindrical metal cans $1\frac{1}{8}$ inches in diameter and $1\frac{1}{2}$ inches high, the midget units resemble small choke coils. When used in circuits employing acorn-type tubes, an entire multi-stage amplifier can be installed in less room than that required by a regular type '50 amplifier tube. Spring clamps make the tiny units easy to mount.

A regular tube dwarfs the midget transformers



Midget ALL-WAVE

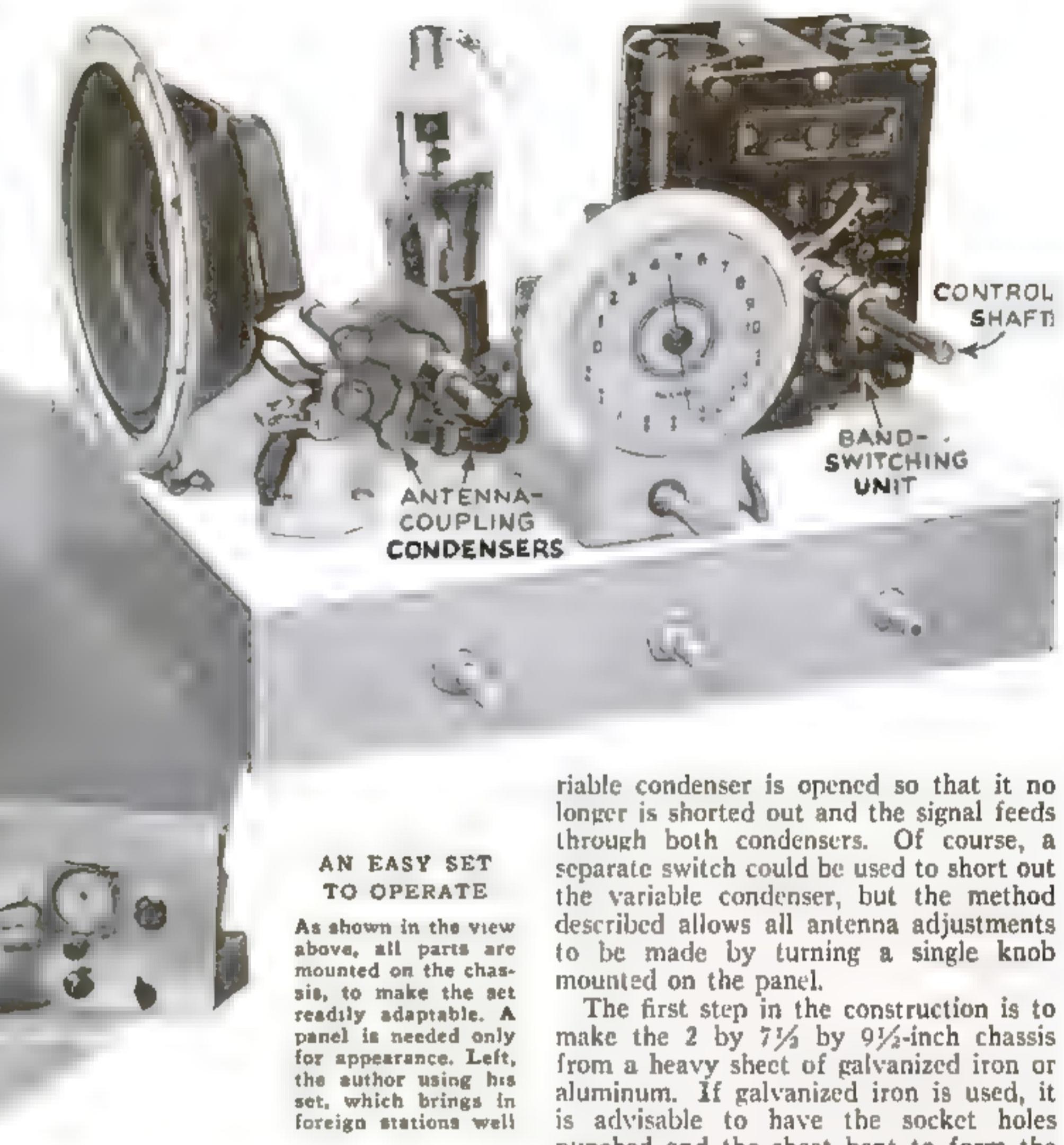
*Here Is a Diminutive Outfit
That Is Specially Designed
For Maximum Performance
With Lowest Cost for Tubes
And Other Parts Required*



ALTHOUGH no larger than one of the popular midget or "mantel" sets, this homemade receiver covers the short waves as well as the broadcast band. Band-spread tuning, wave-band switching, and "from the panel" adjustment of antenna coupling make it extremely easy to operate and, with a good antenna, the builder may expect regular foreign reception.

Maximum performance with a minimum of expense for tubes and parts is obtained through the use of a novel A.C.-D.C. circuit in which two dual-purpose tubes do the work of four. The circuit consists of a pentode regenerative detector, a triode first audio stage, a pentode output stage, and a half-wave rectifier. A 6F7 serves as the combined detector and audio stage and a 12A7 provides the pentode output and rectifier. Transformer coupling, allowing full voltage on the plate of the triode, insures ample volume even on the weakest stations.

To furnish the tight coupling necessary for satisfactory operation on the broadcast band and at the same time provide some means for loosening the coupling for the short-wave bands, a novel system of antenna-coupling condensers is used. As shown in the diagram, two condensers—a .0001-mfd. fixed unit (C_2) and a .00005-



AN EASY SET TO OPERATE

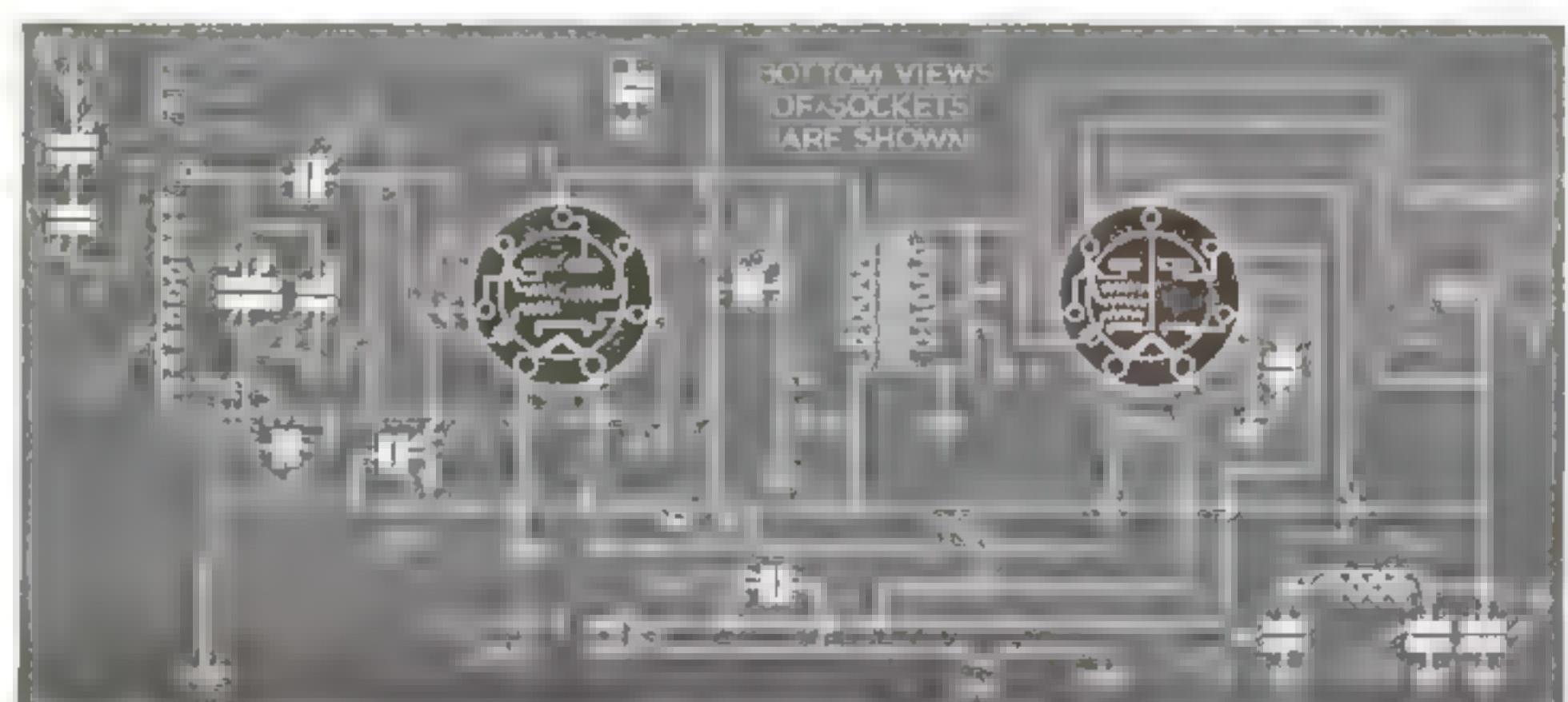
As shown in the view above, all parts are mounted on the chassis, to make the set readily adaptable. A panel is needed only for appearance. Left, the author using his set, which brings in foreign stations well

mfd. variable unit (C_1)—are connected in series. One of the movable plates on the variable condenser is bent in such a way that when the condenser is completely closed the plate touches the adjacent stationary plate to short the condenser completely out of the circuit. This is done when the set is used on the broadcast band to insure sufficient antenna coupling, feeding the signal directly into the grid circuit of the tube through the .0001-mfd. fixed condenser. For short-wave reception, the va-

riable condenser is opened so that it no longer is shorted out and the signal feeds through both condensers. Of course, a separate switch could be used to short out the variable condenser, but the method described allows all antenna adjustments to be made by turning a single knob mounted on the panel.

The first step in the construction is to make the 2 by 7½ by 9½-inch chassis from a heavy sheet of galvanized iron or aluminum. If galvanized iron is used, it is advisable to have the socket holes punched and the sheet bent to form the chassis. In most sheet-metal shops, this will be done free of charge, the buyer simply paying so much a pound for the metal.

In mounting the parts, the band-spread tuning condenser, the airplane-type dial, the antenna-coupling condensers, and the five-inch magnetic speaker are placed above the chassis. To make it possible to use a smaller chassis, the speaker is mounted at one side rather than at the front. The two tube sockets are at the rear of the chassis, with the four-prong coil socket at one side.



The novel A.C.-D.C. circuit which enables two dual-purpose tubes to do the work of four tubes

Receiver EASILY BUILT AT LOW COST

By STANLEY JOHNSON

Mounting the commercial band-switching unit (P.S.M., Sept. '36, p. 55) is simplicity itself—the unit is simply plugged into the coil socket as shown in the photographs. The bother of plug-in coils is entirely eliminated, a convenient switch making it a split-second matter to adjust the receiver for use on any wave band from sixteen to 550 meters.

The remaining parts are mounted under the chassis. At the front are the regeneration control (R_3), the combined volume control and switch (R_7), and the variable tuning condenser (C_5). The two filter-condenser blocks and the filter choke are mounted close to the sides of the chassis at one end. Toward the center is the audio transformer, mounted so that its core is at right angles to that of the filter choke.

Two filter-condenser blocks are used in order to reduce the hum. One filter block contains a 16-mfd. and an 8-mfd. filter section rated at 200 volts, and two 5-mfd. by-pass sections rated at thirty-five volts. The 5-mfd. sections are connected in parallel across the cathode resistor (R_9) of the 12A7 tube. The 16-mfd. filter section is connected on the input side of the filter choke and the 8-mfd. section is wired to the output side. The other block, a dual 8-mfd. unit with the sections in parallel, also is wired to the output side of the filter choke.

There is nothing about the wiring which should cause trouble, provided care is used in making connections to the A.C.-D.C. power cord, the 12A7 tube socket, and the tuning coil socket. Connections to the latter should be made as shown in the diagram furnished with the coil-switching unit. As discussed in a previous issue (P.S.M., Mar. '36, p. 56), the power cord must be connected properly, or the

two tubes will be burned out.

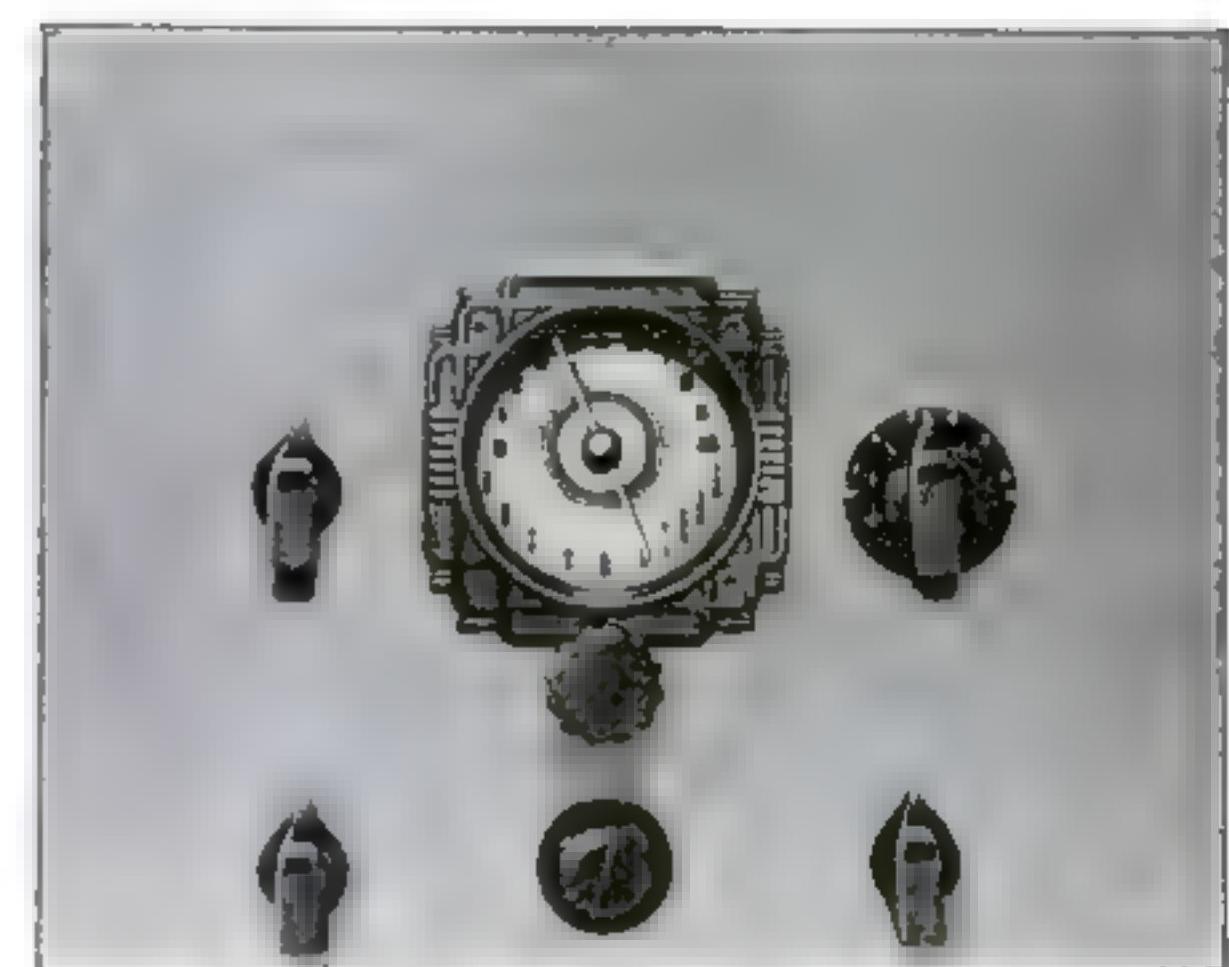
All "ground" connections in the detector portion of the circuit should be made to a single point on the chassis. When wiring the rectifier and audio stages, however, the parts may be grounded to the chassis wherever convenient. Where wires are run through holes in the chassis, they should be protected with a short length of "spaghetti" tubing.

As with any A.C.-D.C. receiver, no direct connection to an outside ground can be used. If necessary to eliminate bothersome hand capacity, the circuit can be grounded indirectly through a .1-mfd. paper condenser.

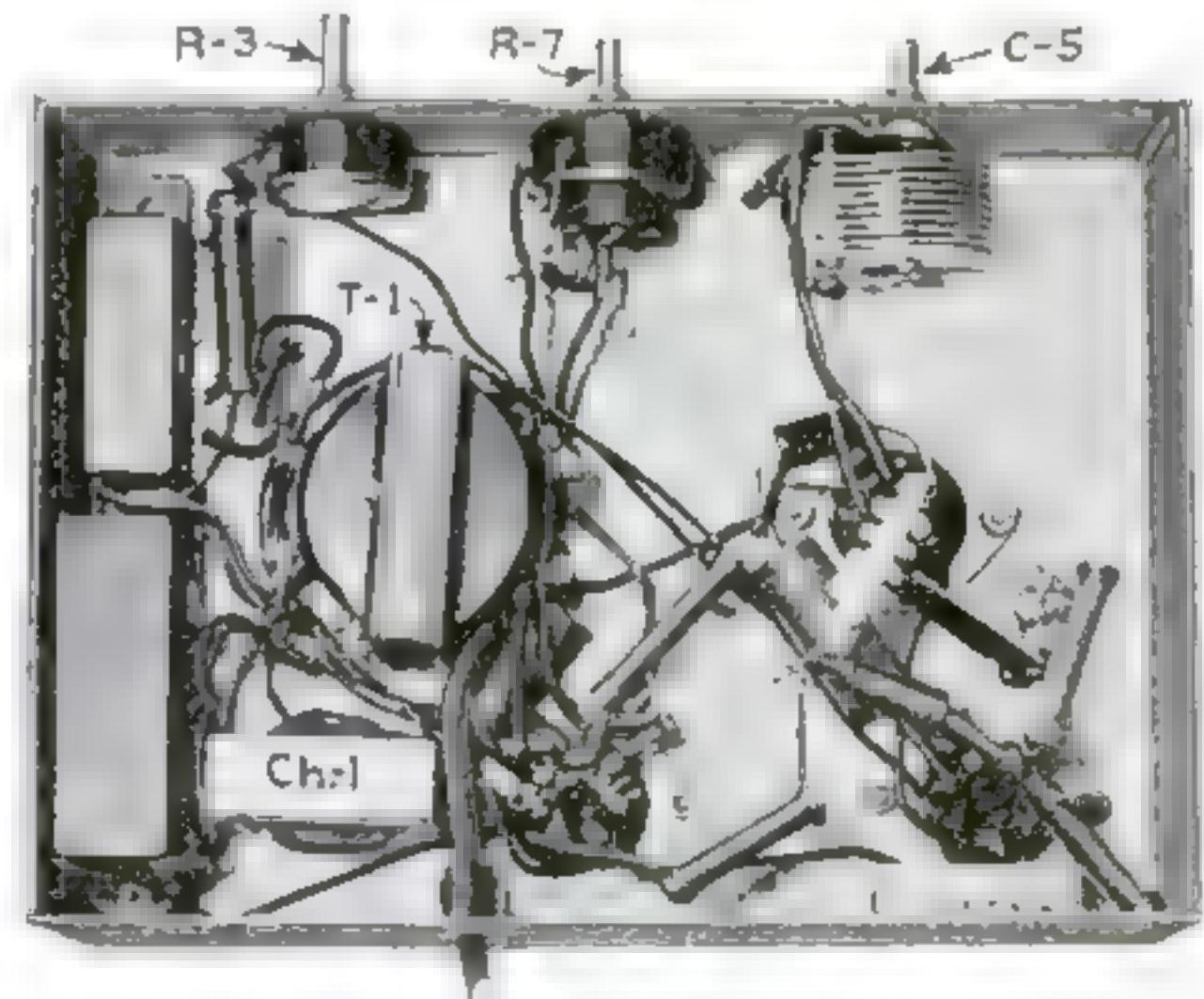
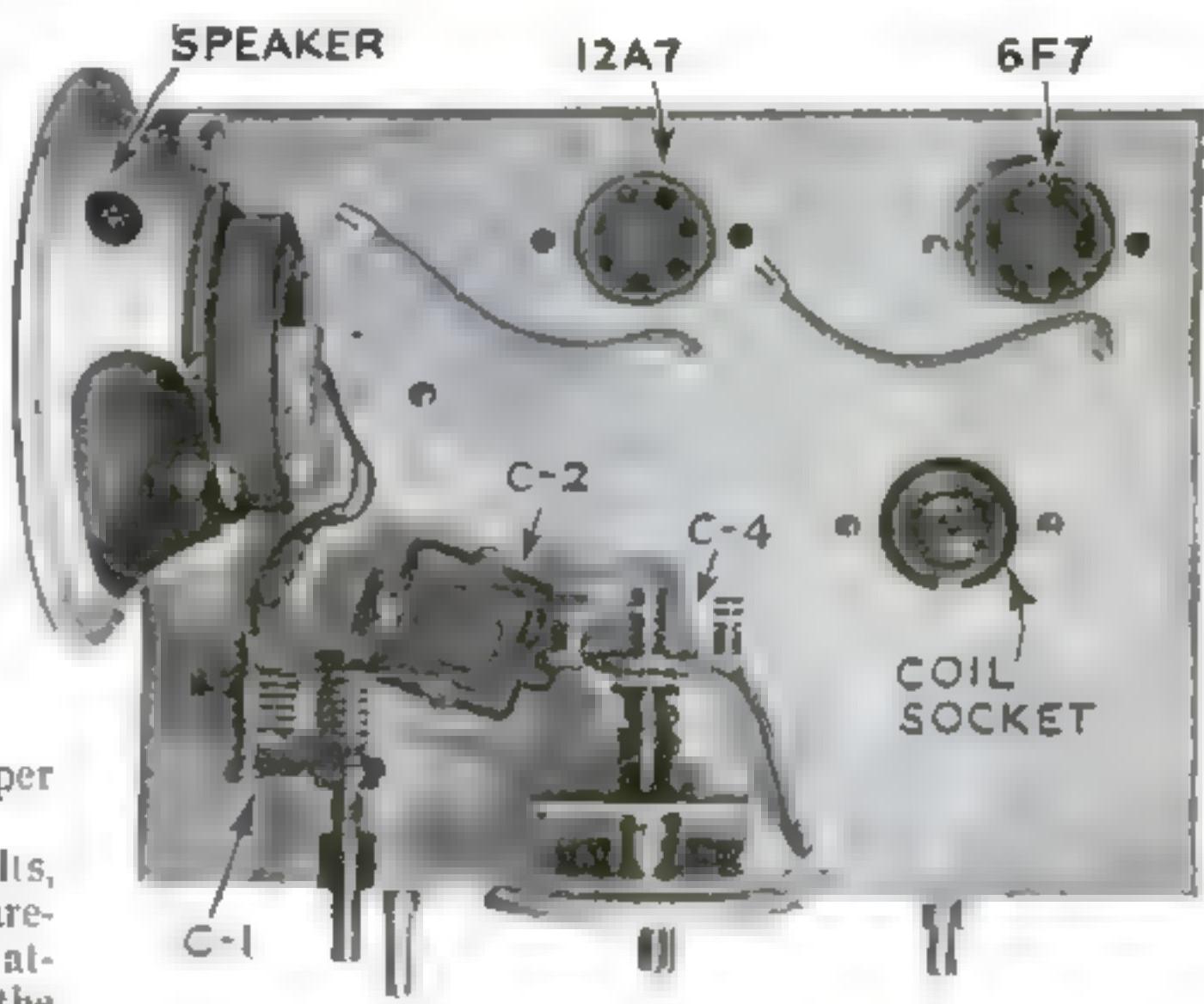
Should the builder desire to equip the set for use with headphones, an open-circuit jack may be mounted on the chassis. One side of the jack, which must be insulated from the chassis, should be wired to the plate of the 6F7 tube or to the pentode plate of the 12A7 tube. The other side should be grounded to the chassis through a .1-mfd. paper condenser.

To get the best results, tune the set slowly and carefully, paying particular attention to the setting of the variable antenna condenser, and use a high, well-insulated

(Continued on page 121)

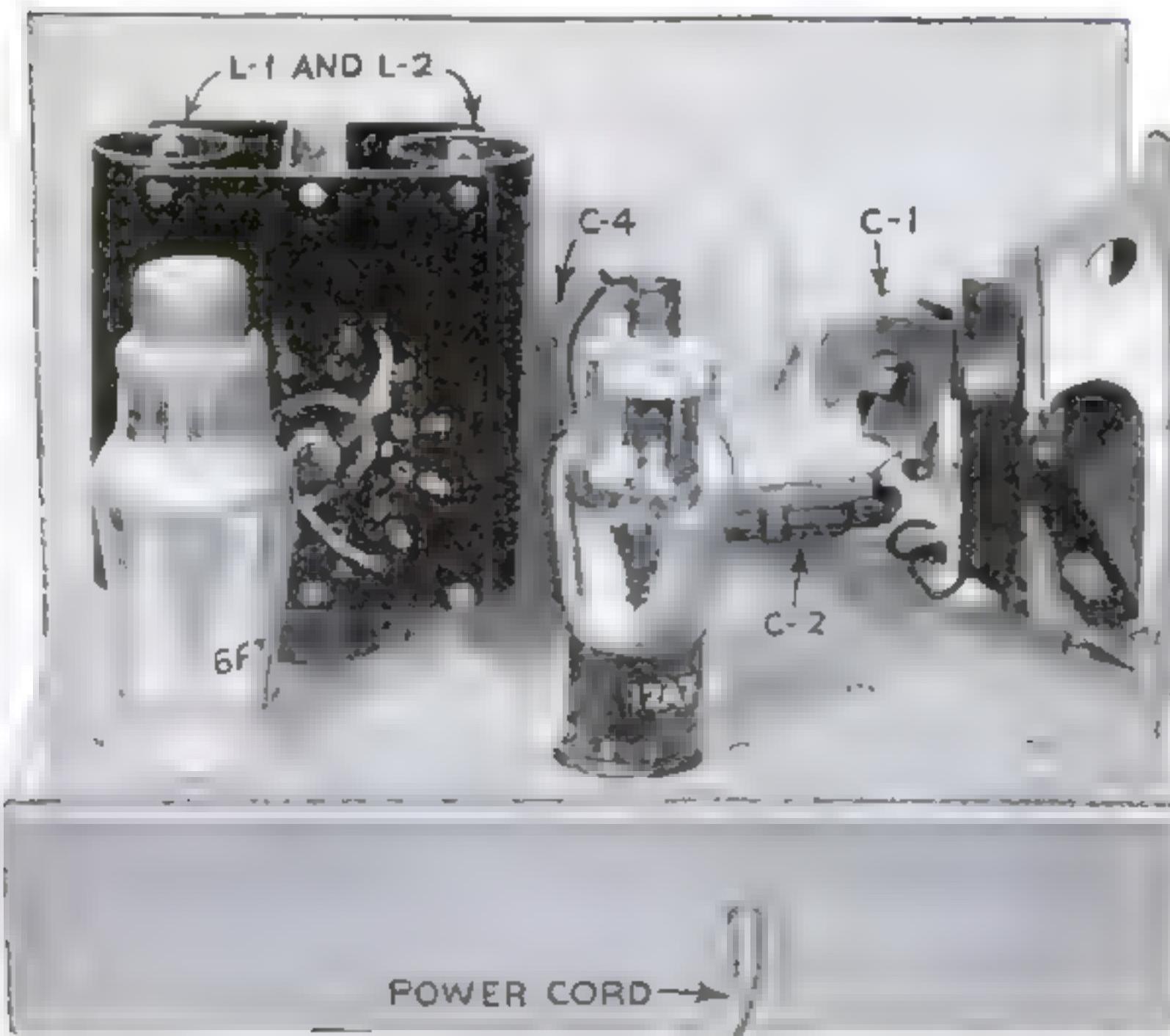


Arrangement of dial and controls on the panels. Any type of dial can be employed for the band-spreading condenser



Top and bottom views of the chassis. In the former, the tubes and band-switching unit have been removed to show arrangement of sockets. Bottom view shows placing of parts

HOW THE MAGNETIC SPEAKER IS MOUNTED
The photograph at the left shows how the chassis appears from the rear, with the two tubes in place. The speaker is placed at the side, instead of in front, to save space



Give Your Car These SIMPLE SAFETY TESTS

By MARTIN BUNN

WILLIS DONAN stared disgustedly at a car that started off from the Model Garage just as he pulled in.

"Some heap of junk, that, eh?" he snorted to Gus Wilson, half owner of the establishment, as the clattering din of the departing car faded into the distance.

"Sure looks it and sounds it," Gus admitted with a grin.

"That's the kind of car they ought to rule off the road," Donan growled indignantly. "Those old rattletaps are a menace to everybody. It's a wonder there aren't more crashes, with the roads full of such crates."

"Because a car's old and noisy, and looks a bit moth-eaten, is no proof that it's a menace on the road," Gus protested. "Take Fred Oakes's car, for example. He's the fellow who just drove away. I'll bet you a good cigar his car's just as safe on the road as yours—and maybe a little bit safer!"

"You're crazy!" Donan exclaimed, his eyes straying pridefully over the sleek, well-polished exterior of his year-old model. "How could that old wreck possibly be in a class with this car for safety?"

"Wait a minute," said Gus, disappearing through the open door of the garage. After rummaging around inside for a while, he returned with a small block of wood in his hand. "How are your brakes?" he asked, walking over to the side of Donan's car.

"Didn't you hear me slide my wheels when I pulled in?" Donan snapped. "If you think my brakes aren't as good as those on that old kettle, you've got another think coming!"

"Let's try them, anyway," Gus suggested mildly, as he climbed into the seat beside Donan.

The latter backed his car out. When he got it turned around and headed down the road, Gus placed the small block of wood on the floor between his feet. "Now stop her as quick as you can," he directed.

Donan slammed on his brakes; there was a squeal of rubber scraping, and the block of wood gently toppled over.

"Now try it again," said Gus, as he stood the block up again, this time edge-wise to the direction of travel of the car.

As soon as he reached twenty-five miles an hour, Donan jammed both pedals to the floor with a vicious kick. The tire squealed as before, but the block did not fall over.

"Not so good," grumbled Gus. "Fred Oakes, now, in that 'old rattletrap,' can tip that block over from either position. Your brakes are only fair."

"I don't see how that can be," argued Donan. "I'm sliding my wheels, and that's all any brakes can do."

"Trouble is," Gus corrected, "you're only sliding one wheel. The brakes on the other wheels can't be doing much. That's worse than having them all working weakly, because one tight brake will make you skid like all get-out on slippery going."

"How do you know only one wheel is sliding?" Donan asked.

"Look back," replied Gus. "You can see the rub mark on one side of the road and not on the other; if both wheels on the same side locked, and the others weren't holding, the car would slew around enough that the mark would be wider than one tire could make."

Donan got out and carefully examined the tire mark on the pavement. "You win, Gus," he grunted, fishing a huge cigar out of his pocket.

"I never saw brakes tested that way before. Where'd you get this block?" he asked, picking it up and looking it over. "And how do you know it really tells anything about the brakes?"

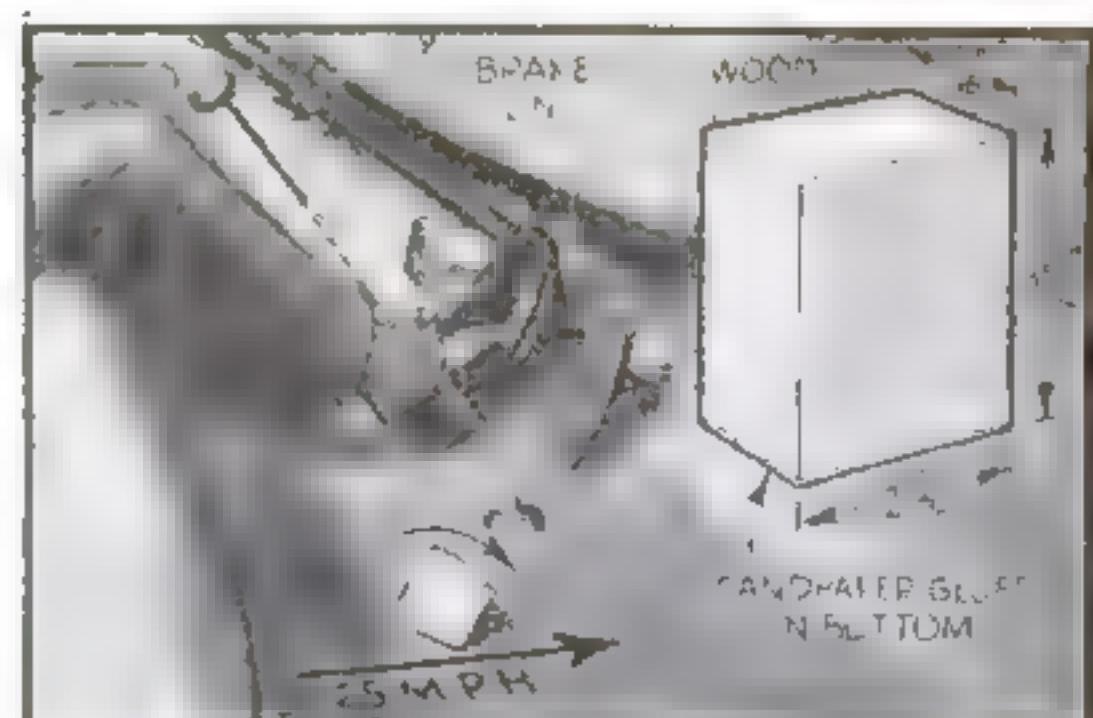
"I made it," Gus replied, "but a man connected with the National Safety Council worked out the idea—and it's a clever one, too."

"Made of fir, I see," Donan commented. "How do you load it inside so it will tip over at just the right brake pressure?"

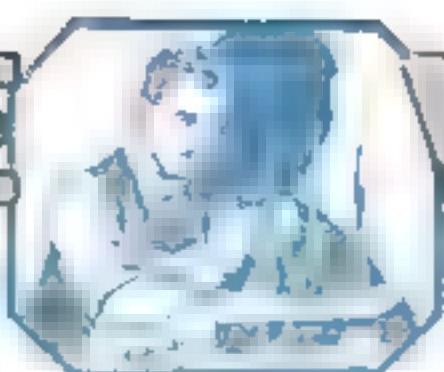
"It isn't loaded, and the kind of wood hasn't anything to do with it," Gus explained, taking the block in his hand. "It could just as well be made out of pine, or oak, or mahogany, for that matter. Even the size doesn't make any difference, so long as the height, width, and thickness bear a certain relation to each other. The thickness has to be just forty-four and six tenths percent of the height and the width should be seventy-five percent of the height. The block has to be squared up nicely, and you have to have this piece of sandpaper

(Continued on page 120)

How to test the efficiency of your brakes with a small block of wood. Dimensions of the block are shown



I'll bet a good cigar," said Gus, "that Fred Oakes's car, there, is just as safe on the road as yours—maybe safer."



WALNUT Corner Cupboard

... A PIECE YOU CAN BE PROUD OF BUILDING

By Arthur Collani



A
NATIONAL
HOMEWORKSHOP
GUILD
FEATURE

THE original from which this walnut corner cupboard was adapted is on exhibition in the Metropolitan Museum of Art, New York. It was built in New England, presumably Connecticut, around 1740-1750 and is one of the finest and best-proportioned corner cupboards that have come down to us, representing the culmination of a style that was well distributed throughout the colonies.

What few changes have been made are mainly in size and detail. The height (and proportionate width) has been reduced; the single door in the lower compartment has been replaced with two; the number of panes in the upper door has been reduced from fifteen to twelve so that the shelves could be hidden behind the muntins; and modern laminated plywood has been used in the back panels with subsequent changes in the structure of the main body part, or "carcase," to use the correct cabinetmaking term. Throughout, the construction follows the best practice, and any cupboard made in accordance with the plans and description will provide an heirloom as sturdy and long-lived as any of those that have descended to us from the past.

All the work was done with a circular saw and a band saw as the only power tools. The lumber (see the completely itemized list on page 63) was dressed to thickness at the mill. The hand saw can be dispensed with at no material increase in the labor of construction, but if the builder is going to carve the moldings himself, the circular saw is almost a necessity. Without it or molding planes, and unless the carver is an expert, the additional labor would be considerable, and the results probably would not be satisfactory.

The first piece to be got out is the rear post or backbone. Into this and the side posts of the carcase are mortised the side rails. Observe that the top, middle partition, and bottom are all set into rabbets, which must be cut into the posts before the panels are set in their grooves and the joints glued and pegged. Notice, too, that the continuations of the rabbets into the tops of the side posts do not go all the way through, but are stopped to meet the inside edges of the setbacks. This is shown clearly in the perspective drawing of the front top corner. The top, middle partition, and bottom are made of two boards joined with dowels and glue.

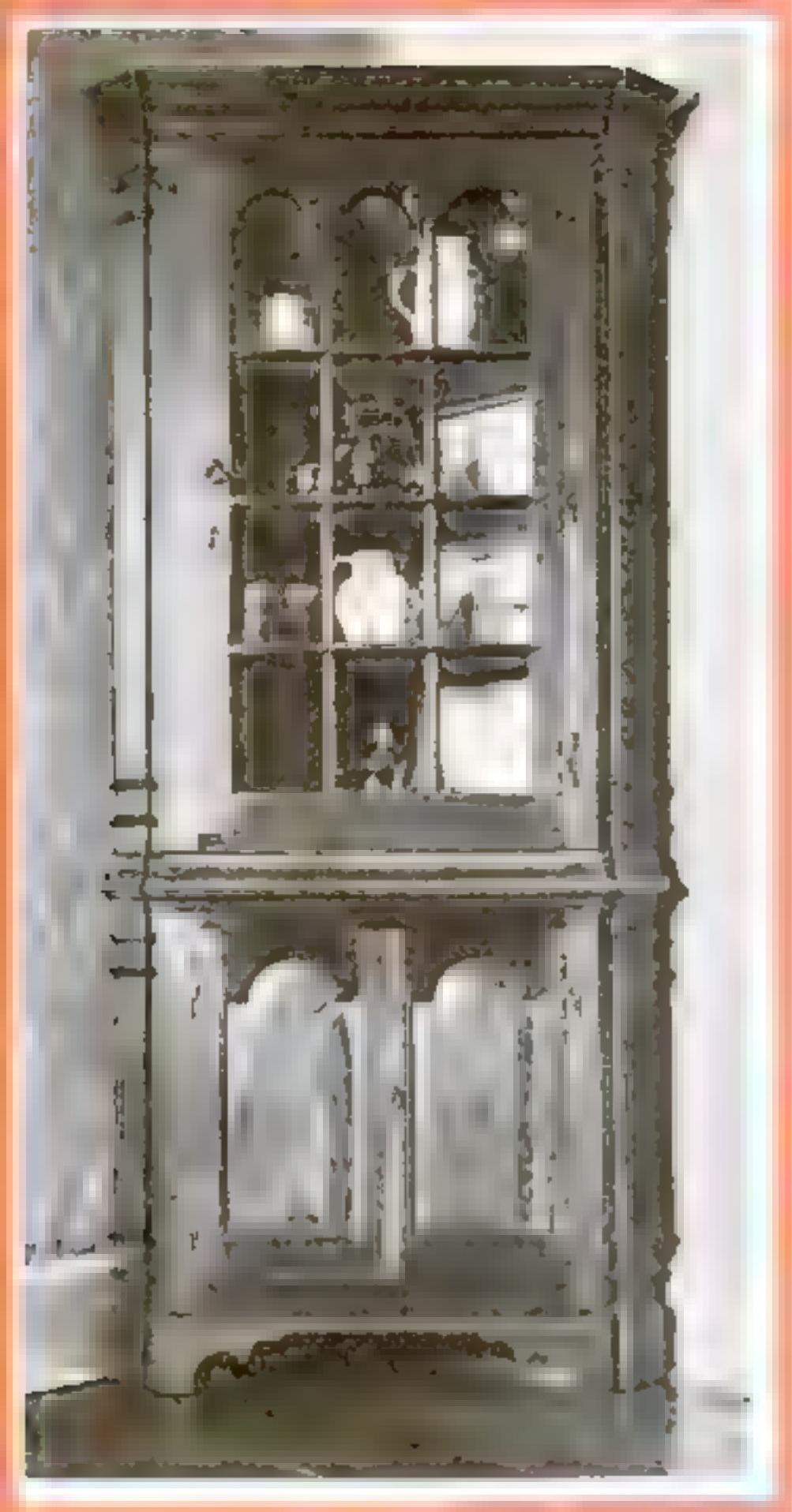
After these come the first pieces of walnut, the setbacks. These are rabbeted to receive the side posts and the middle partition and bottom. The top is dovetailed into the setbacks. In cutting the dovetails, it is best to cut the top first and when



Designed after one of the finest Early American cupboards in existence, this piece will enhance any dining room of Colonial style.

CHALLENGE TO CRAFTSMANSHIP

You probably have a fairly well-equipped home workshop by this time and have turned out a lot of small pieces of furniture and other woodwork. The chances are, though, that nothing you have ever tried has really challenged your craftsmanship. You don't actually know, do you, just how good a job you could do if you had a hard enough mark to shoot at? Well, here's the mark! This corner cupboard is so beautiful that when you have built it you will have a matchless piece of furniture to enjoy during your whole lifetime ... and an heirloom that can be passed on from generation to generation.



One advantage of this cupboard is that it has been scaled down slightly in size to look well in modern dining rooms, often rather small

this is finished, to scribe the outline on the tops of the setbacks. Care must be taken to see that the inside edges of the setbacks are cut at exactly the correct angle— $67\frac{1}{2}$ deg. from their faces.

In fastening the top to the sides of the carcase and the setbacks to the side posts, the screws should be alternated—first one from the top into the side, and then one from the side into the top. This forms a positive lock which alone, without the added strength of the screw threads, would prevent the joint from opening.

Next comes the front facing. The rails are mortised and tenoned and glued and pegged into the posts; the rabbets cut for the top, middle partition, and bottom; and the outer edges of the posts carefully matched to fit the angles of the setbacks. Here again the continuations of the rabbit in the top rail are not carried right on through the posts, but are stopped at an angle to match the shape of the top. Besides being screwed to the top, middle partition, and bottom, the front facing is fastened with glue and long screws set at an angle through the edge of the front face post into the setback. The heads of the screws are covered with wood plugs.

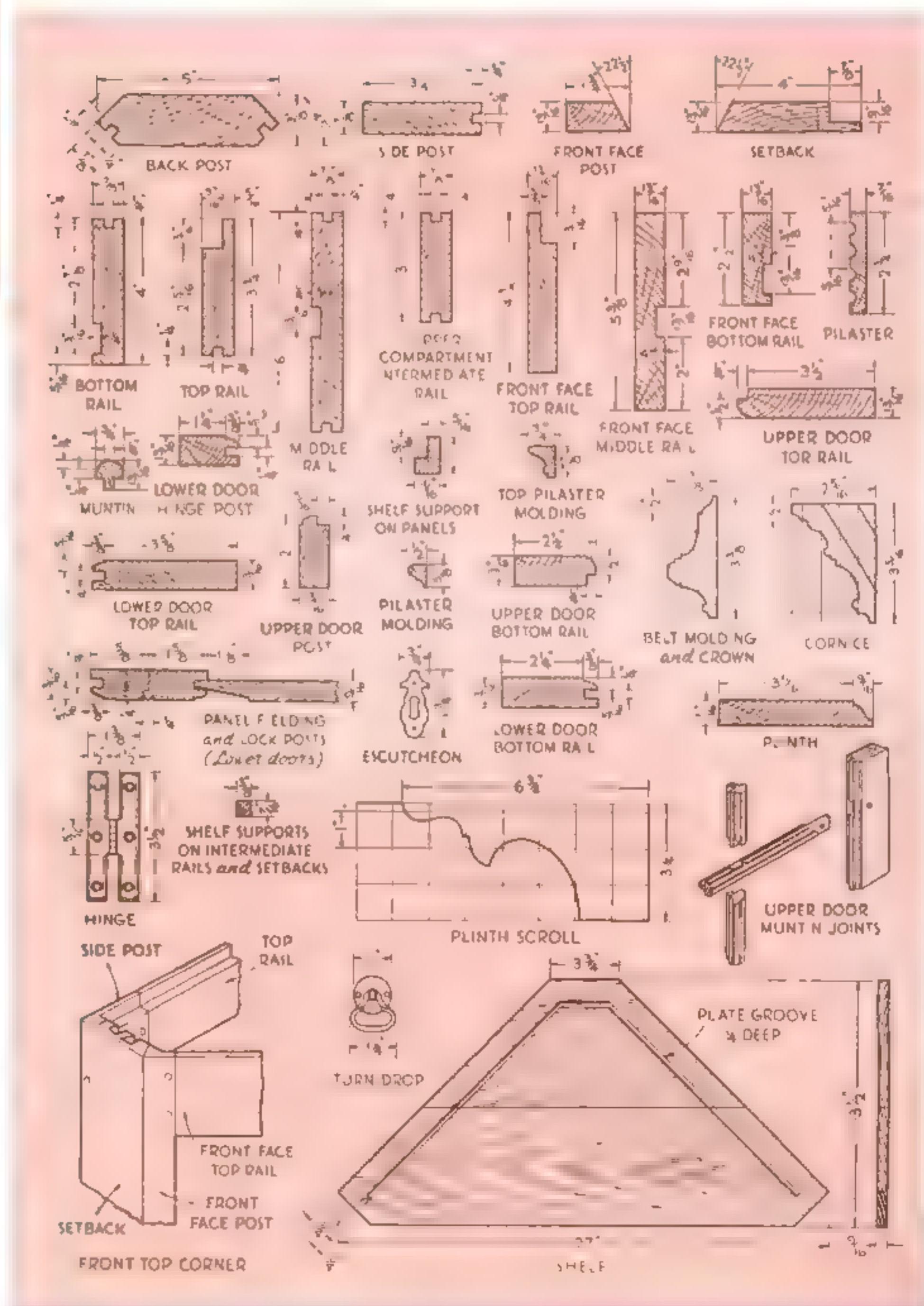
Now for the pilasters. The flutings are first carved out roughly with a small gouge and then finished with a 5/16-in. rat-tail file. This file is broken off about 3 in. long, and the tang heated and bent up at an angle. The broken end should be ground off square, as much of

the work is done by this edge. With this tool the flutes can be finished easily and quickly—uniform in cross section and smooth and straight throughout their length. The pilasters are glued on and fastened with screws under the moldings and a brad or two in the long stretches.

In making the moldings, the square edges of the fillets are located in two directions with carefully measured saw cuts, and the large coves are cut to the proper depth at several points, roughed out with a curved chisel until the saw marks are taken away, and finally finished with scraper and sandpaper. The small concave sections are cut at their terminal points with shallow saw cuts, and the remaining material is taken away with a gouge and finished with the file used on the pilasters or a piece of coarse sandpaper on a curved block. The convex surfaces are cut down

with a small plane. Moldings so made do not have the precise regularity that machine-made moldings have, but they possess the softness of the handwork seen in antique furniture.

The plinth or molded and scrolled base member is screwed on from the back through the setback and pilasters, the posts of the front facing, and the edge below the rabbet in the lower rail. Inside the corners formed by the side posts, the setbacks, and the posts of the facing, a maple block should be screwed to hold these parts firmly together. This block should extend $\frac{1}{4}$ in. below the bottom of the other members, forming the real foot and preventing the chipping or splintering of any of the visible parts in moving. This slight blocking under the front tends to increase the stability of the cupboard by moving its center of gravity nearer the center of the area formed by the three feet. The great mass of material on the front of the piece and the comparative



THE DESIGN IS ADAPTED FROM A PIECE IN THE METROPOLITAN MUSEUM OF ART

lightness of the back parts make this very desirable. Too, this blocking makes the cupboard fit more snugly into the corner of the room, as baseboards never permit standing it flat against the wall.

The belt molding is screwed on from the outside under the crown and from the inside with supplementary screws. The cornice is screwed on from the inside with two rows of screws, long ones into the top and short ones into the bottom. It will be found in laying out the angles for cutting the cornice that a strict adherence to mathematical exactitude would make the front piece meet the outer ones (those on the pilasters) at the top, entirely eliminating the notch, which is so essential in preserving the form and character of the cornice. Accordingly, the angle is distorted somewhat and thrown out a little to give the desired break in the top edge. This will mean that the thin sections of the cornice that spring from the edges of the pilasters will need a little

additional hand carving.

The construction of the upper door is fully shown in the drawings. In pegging the joints of the top rail and the posts, the pegs should be staggered slightly. Move the top peg somewhat farther away from the edge to reduce the danger of splitting the post, for all pegs should fit very tightly to compensate for any shrinkage later. The drawings for the lower doors, too, are self-explanatory. There is no short cut in making the arched rails of the doors with hand tools, but while the work is somewhat tedious and requires care, there is nothing really

(Continued on page 90)

List of Materials

MAPLE

Pc.	T.	W.	L.	Description
1	1 1/4	5	73	Back post
2	1 1/4	1 1/4	73	Side posts
2	3/8	2 3/4	17	Top rails
2	3/8	3	17	Upper compartment intermediate rails
2	3/8	6	17	Middle rails
2	3/8	4	17	Bottom rails
1	13/16	14 5/8	28	Top
2	13/16	14 8	28	Middle partition and bottom
2	1	4	4	Panth blocking
4	9/16	1 1/2	27	Shelves
6	11/16	1	17	Shelf supports on panels
2	1 1/4	7/16	17	Shelf supports on intermediate rails
8	3/8	7/16	2 1/4	Shelf supports inside setbacks

THREE-PLY MAPLE PANELS

2	3/4	14 5/16	19 1/2	Top panels in upper compartment
2	3/4	14 5/16	17	Lower panels in upper compartment
2	3/4	14 5/16	18	Panels in lower compartment

WALNUT

2	13/16	4	73	Setbacks
2	13/16	1 1/4	73	Front facing posts
1	13/16	4 1/8	23	Front facing top rail
1	13/16	5 1/8	23	Front facing middle rail
1	13/16	2 2	23	Front facing bottom rail
2	7/16	2 1/4	73	Pilasters
1	11/16	4 1/4	42	Panth
1	1	4	42	Belt molding
1	3/8	11/16	42	Belt molding crown
1	13/16	4 1/8	48	Cornice facing
1	1	2 1/2	48	Filler behind cornice facing
1	3/8	1 1/2	12	Top molding on pilasters
1	3/8	5/8	72	Pilaster moldings
2	13/16	2	38	Panels of upper door
1	13/16	3 1/2	20	Top rail of upper door
1	13/16	2 1/4	20	Bottom rail of upper door
3	13/16	3/4	20	Cross muntins of upper door
6	13/16	3/4	8 3/4	Vertical muntins of upper door
2	13/16	3/4	9	Bottom vertical muntins of upper door
2	13/16	1 1/4	19 1/2	Hinge posts of lower doors
1	13/16	1 1/4	19 1/2	Outer lock post of lower doors
1	13/16	1 1/4	19 1/2	Inner lock post of lower doors
2	13/16	4	9 1/4	Top rails of lower doors
2	13/16	2 5/8	9 1/4	Bottom rails of lower doors
2	9/16	7 1/4	16	Panels of lower doors
1	1	2 3/4	2 1/4	Stop for lower doors

Note: All dimensions are given in inches and are finished sizes.

HARDWARE

2	brass escutcheons for upper and lower doors
1	cupboard turn, 1 1/4 in. across bow, for upper door
7	brass H-Hinges, 3 1/2 in., for upper and lower doors
1	brass flush bolt, 1 1/2 in. long, for inside lower door
1	brass door lock, 1 in. to pin, for upper door
1	brass door lock, 11/16 in. to pin, for lower door
	Iron wood screws and brass wood screws as required

MISCELLANEOUS

9 pc.	3/8-in. sheet glass 5 1/2 in. wide and 8 in. long, for lights in upper door
3 pc.	3/8-in. sheet glass 5 1/2 in. wide and 9 in. long, for top lights in upper door
Liquid glue	
Putty	
Boiled linseed oil	
Polishing wax	

MATERIAL COST

Maple lumber, 34 ft. b.m. (board measure) at 15 cents	\$ 4.95
Maple panels, 2 pc., 3/4 by 30 by 72 in., good one side	5.40
Walnut lumber, 30 ft. b.m. at 55 cents	16.50
Hardware	.976
Glass, glue, putty, boiled linseed oil, and polishing wax	2.90
	\$39.51

Approximate hours labor (estimated) 225

A broken piece of
rat-tail file is
used to finish
the fluting of
the two pilasters



IT GIVES MORE PRACTICE IN CABINETMAKING THAN TEN ORDINARY PROJECTS

Toy Target Registers Anger When Hit

IN THE shooting game illustrated below, Homeless Harry is seen sitting peacefully on a high board fence. If there is a good marksman in the vicinity, however, he won't be sitting there long. A well-aimed "bullet" will cause him to take a tumble, but he will pop up immediately to express his justifiable anger.

Only three pieces are required, because the novelty operates on the simplest of principles—gravity. For "artillery," either toy pop guns or homemade rubber-band guns will serve.

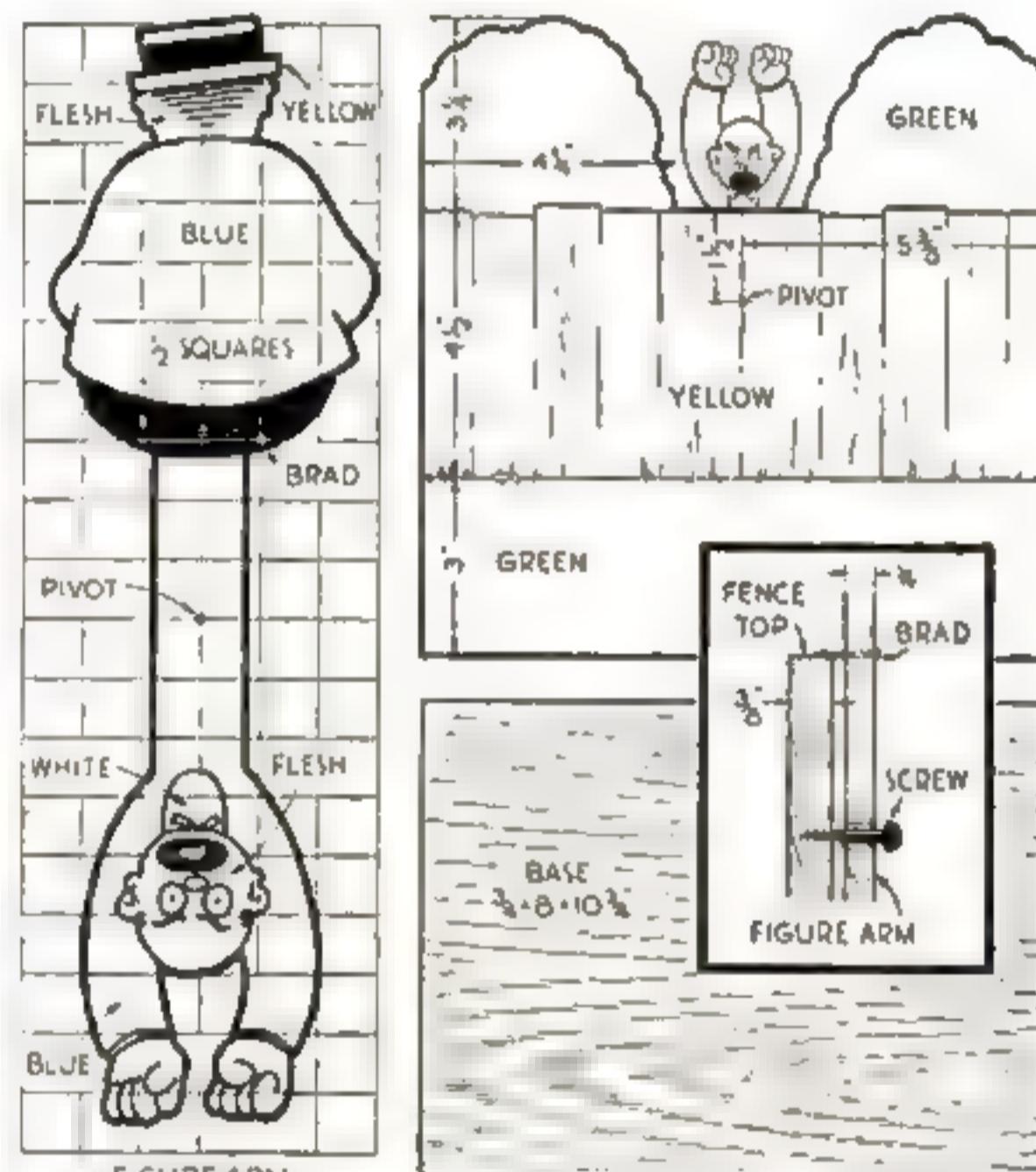
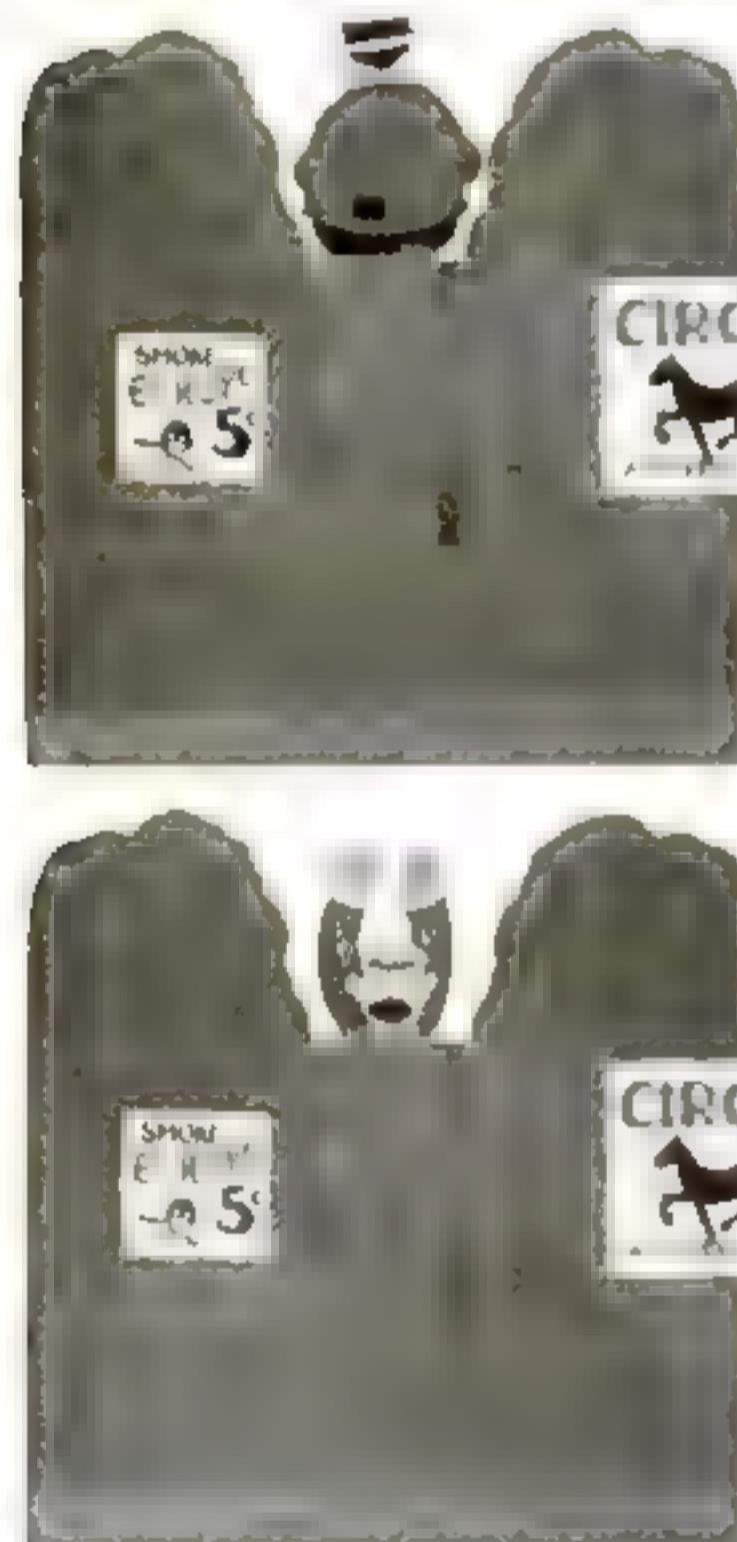
Enlarge the pattern for the double-ended target arm to the required size by means of the squares. Transfer the outline to a piece of $\frac{1}{4}$ -in. plywood and jig-saw to shape. Follow the same procedure with the front piece, using material $\frac{3}{8}$ -in. thick.

To insure stability, the base is made of $\frac{3}{4}$ -in. thick wood. Assemble the base and

front piece with glue and finishing nails, set the nails, and fill the holes. Next sandpaper the front and figure arm thoroughly, after which a coat of flat paint or prepared enamel undercoat should be applied. When this is dry, finish the pieces in the colors noted or in a combination of your own.

Drill a hole in the figure arm at the point shown. A screw is put through this hole, and the point driven into the back of the "fence." The arm should turn easily on the pivot, and the screw should be sufficiently long to allow the arm a play of at least $\frac{1}{4}$ in.

A brad is driven into the target at the point indicated, where it will project slightly over the edge of the fence and serve to keep Homeless Harry in his peaceful position. A "hit" moves the figure back, the brad loses its hold, and the tramp takes a tumble.—CARL SORENSEN.



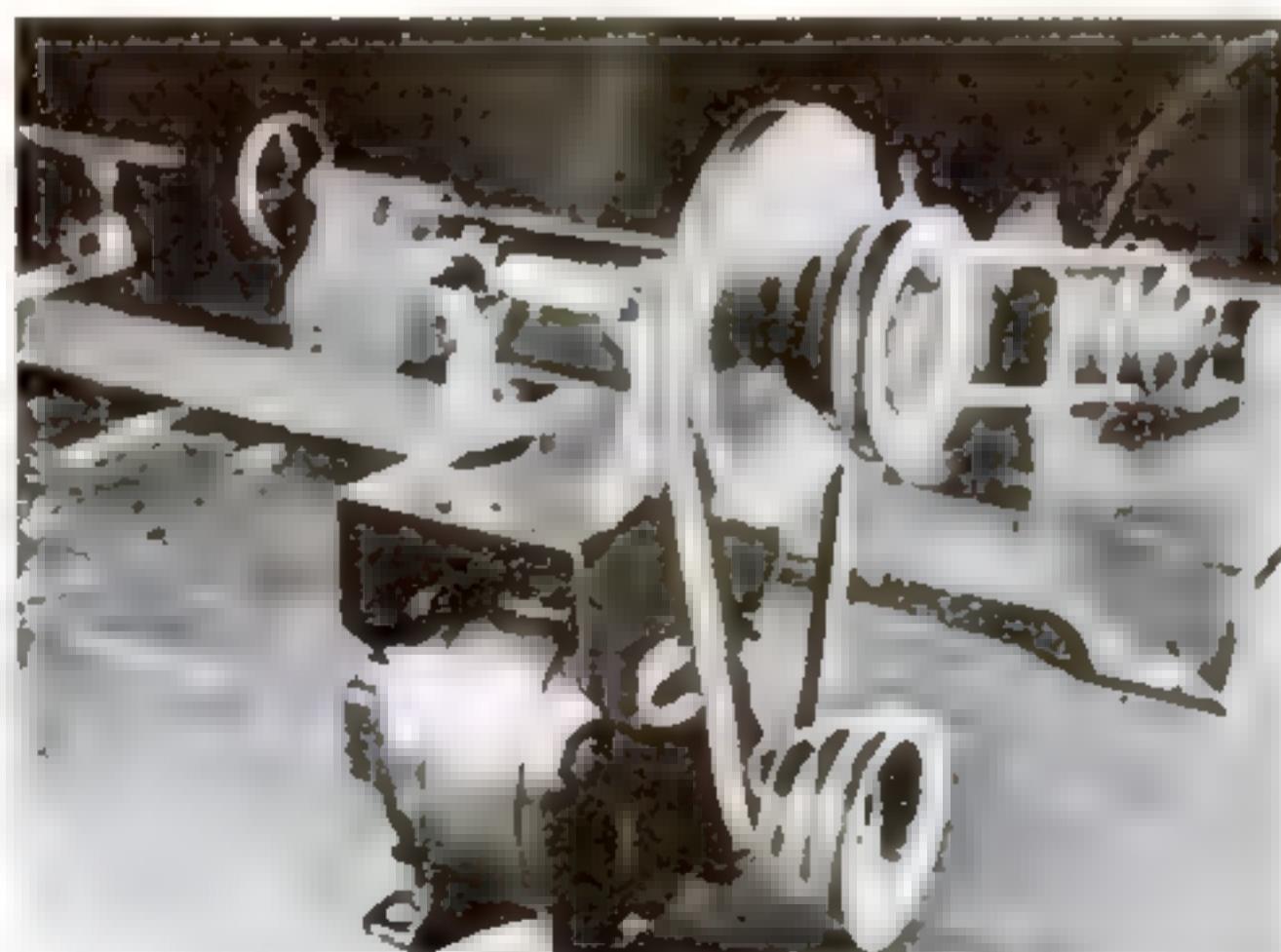
At left are two photographs showing the target before and after being hit. The three parts are made as in the drawing, and the figure is pivoted to the fence

LOW-SPEED COUNTERSHAFT FOR LATHE

THE slow speeds required for metal turning on a small home workshop lathe are easily obtained by means of the simple countershaft assembly illustrated. When higher speeds are needed for wood turning or polishing, the short belt from the motor to the countershaft is removed and the lathe run directly from the cone pulley on the motor, thus eliminating the operation of unnecessary belts and shafts.

A piece of 20-gauge metal, bent and fastened to the four motor-frame bolts, forms a sturdy and space-saving table upon which to mount the bearings. The latter should be self-aligning and of adjustable height.

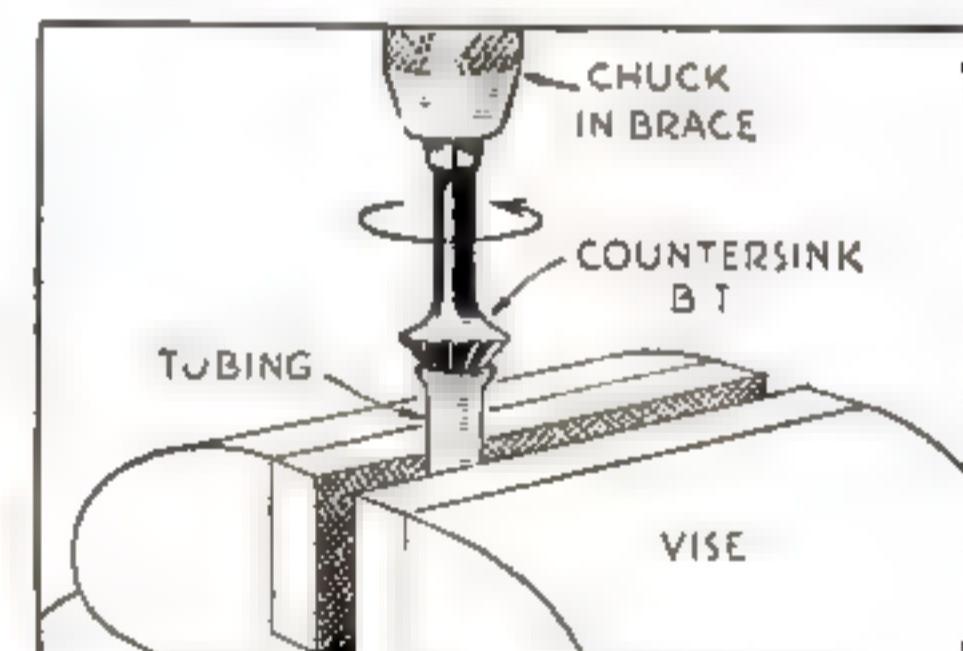
Note that the midpoint between the motor shaft and the countershaft is on the same plane as the center line of the lathe spindle.—ARNOLD S. LUTES.



BOOKSHELF MADE FROM OLD RADIO CABINET

DISCARDED table-model radio cabinets, if of good quality and sufficient size, can be converted into useful and decorative hanging bookshelves. Before removing the front panel, cut the cabinet down to a depth of about 6 in. Then remove the front paneling carefully and save it for making a small utility drawer. From the point where the arch joins the sides, measure down 9 in. and nail in the shelf, flush with the sides. The remaining space, approximately 5 in. in a cabinet of the type illustrated, is used for the drawer.

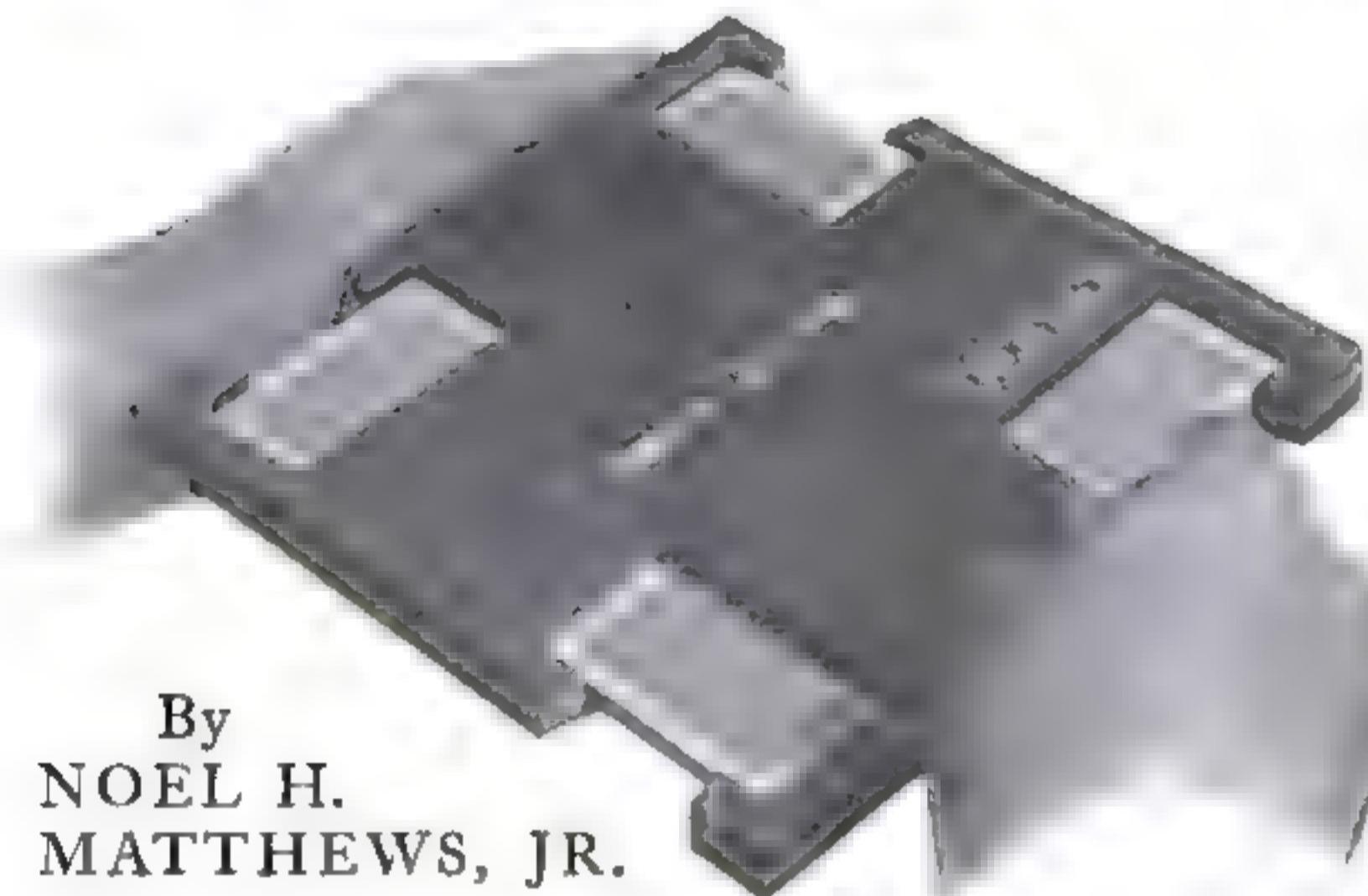
To relieve the straight line at the bottom, a trimming piece is cut from a board about $2\frac{1}{4}$ in. wide and applied as shown. The bookshelf is then completed by adding a back. This is cut to shape from a piece of veneer and tacked to small cleats so that it comes flush with the back. The whole is sanded lightly with fine sandpaper and refinished with two coats of varnish stain. Screw the cabinet to the wall so books are at eye level.—E. E. SWANSON.



COUNTERSINK BIT USED TO FLARE TUBING

FOR putting flared ends on thin-walled copper and brass tubing, an old countersink bit will be found useful. Merely insert the tool in a brace, place in the end of the tube, and turn left-handed while exerting a downward pressure. Since the edges of the bit face backward, they have no tendency to cut into the metal. The tubing is given a uniform flare corresponding to the angle of the bit, usually 45 deg.—W. C. W.

EASY WAY TO MAKE A SET OF Boards for Duplicate Bridge



By
NOEL H.
MATTHEWS, JR.

BOARDS for playing duplicate bridge can be made at home with very little trouble. They are less expensive, and at the same time more durable and distinctive, than ordinary commercial boards.

Each board consists of four containers or "pockets" for holding the hands of cards, as well as an arrow to indicate the direction, and information as to the vulnerability of the players and the location of the dealer. Although any number of boards may be played, the specifications given below are for a set of twelve.

A laminated construction is the most convenient, $\frac{1}{8}$ -in. pressed composition board being used for the tops and bottoms, and $\frac{3}{16}$ -in. strips of white pine for the center sections. A 4 by 6-ft. piece of the composition and 20 ft. of 1 by $\frac{3}{16}$ -in. white pine will be sufficient for twelve boards.

For accurate work, the pocket dimensions may be laid out with an awl on the smooth side of twelve pieces to be used as the tops, and each may be cut separately on a jigsaw to within a safe distance of the line. A quicker but less exact method is to cut several at once, after having first bolted the pieces together outside the final border. The 7-in. square is left rough and untrimmed until the gluing has been completed. The insides of the pockets are finished to the line with a file and small sandpaper blocks.

Then the 7-in. square is laid out on the smooth side of the bottom pieces, and the $1\frac{1}{4}$ -in. semicircles as well, but the latter are not sawed out until the whole has been assembled.

The $\frac{3}{16}$ -in. thick pine strips are sawed to a width of $\frac{1}{2}$ in. and planed smooth on one edge. The strips that go around the outside are cut to about $\frac{3}{4}$ in. over their final length. Cut a 45-deg. miter in one end of each.

The positions of the inner partitions are marked off and, after

they have been cut to size, these inner partitions, as well as the outer strips, are glued on the rough side of the toppiece in their relative positions.

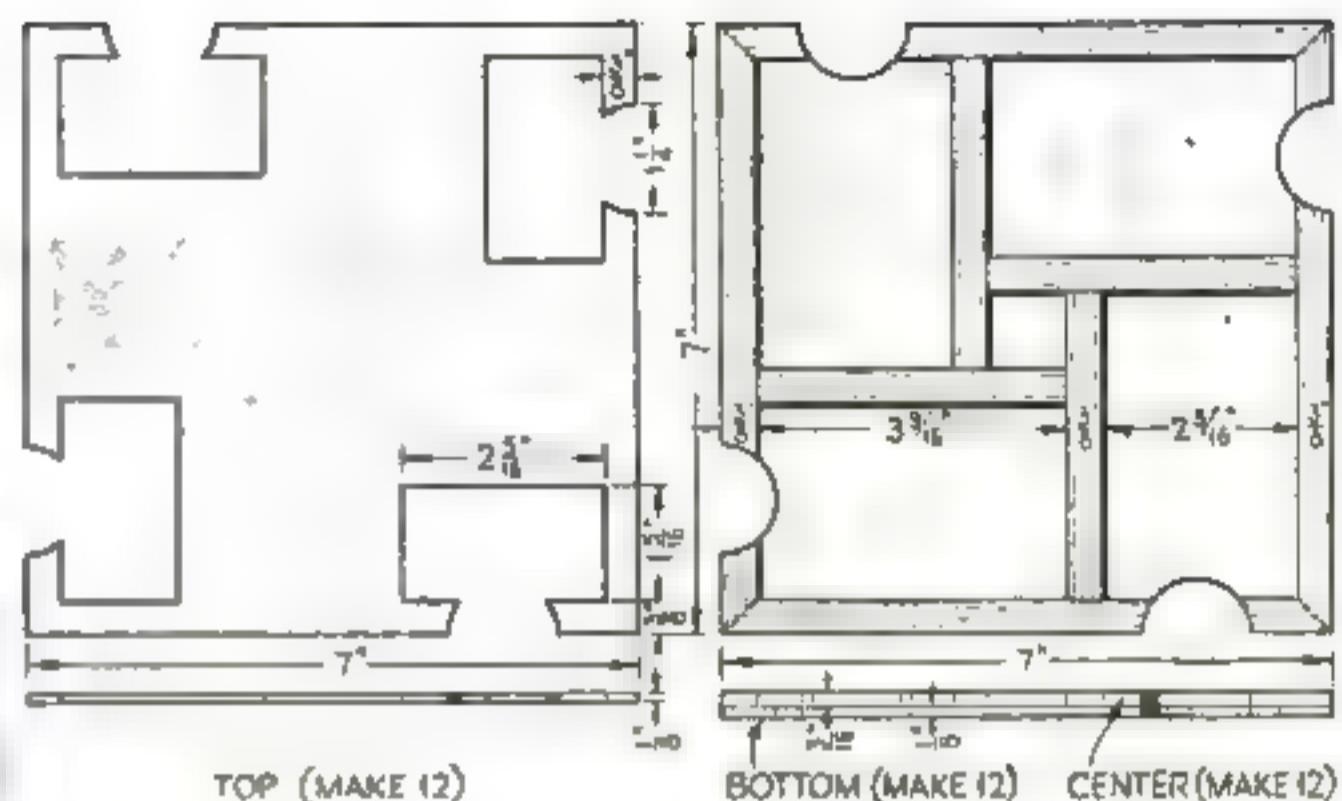
When the glue has set and the open pockets have been tested for size, the smooth side of the bottom is glued to the pine center section, and the whole is put in a suitable press to dry for at least twelve hours.

After the glue has dried, the finger holes are cut and sanded, and the board is planed to 7 in. square.

Lettering may be avoided to some extent by enameling the vulnerable pockets red and those which are not vulnerable, black, as follows:

Board No.	Dealer	Vulnerability
1	N	Neither
2	E	N and S
3	S	E and W
4	W	All
5	N	N and S
6	E	E and W
7	S	All
8	W	Neither
9	N	E and W
10	E	All
11	S	Neither
12	W	N and S

The center of the back (which is rough) is filled with a composition filler, sanded, and enameled black, after which a white enamel or gold (*Continued on page 95*)



The top and bottom members are cut from $\frac{1}{8}$ -in. pressed composition board, and the divisions are made from $\frac{3}{16}$ -in. white pine. The outside edges are smoothed after all parts are glued



The reverse side is covered with felt through which a 1-in. hole is cut at the center to reveal the number



The pine strips are first glued to the rough side of the toppiece and tested for squareness, after which the bottom is cemented on



Not until a board has been completely assembled and the cement has been allowed to dry for at least twelve hours in a press are the edges trimmed to the line with a plane and sandpaper



Completed lamp and, above, the assembly before the orange colored glass is slipped into the grooves formed in the tin moon

NOVELTY lamps are always in demand, and this one makes an unusual appeal, especially to children, because it portrays a wise old owl sitting on the horn of an orange colored moon. To do it justice, it should be seen illuminated.

Turn the base and post from wood to match the furniture with which the lamp will be used. For the moon, you will need some tin, plywood, and a piece of glass. The tin should be 2 in. wide and long enough to make the inner and outer edges of the moon. Have the tinsmith groove one edge by machine to make a seat for

Amusing Moon-and-Owl Lamp

the glass front. The back of the moon is cut from plywood, and the plain edge of the tin is nailed to it with small nails. Leave the ends loose until the wiring is installed and the glass front has been fitted. At the same time the back is sawed out, a pattern may be cut from heavy card for use in cutting the glass front.

The two lamp sockets should be suitable for medium-size 110-volt bulbs. If you want a brighter light, three will be better. These small bulbs draw but little current and do not get very hot. The wire is carried down through a hole in the post and brought out at the back or through the edge of the base.

The front of the moon is cut from ordinary window glass with a common wheel glass cutter. Place the pattern on the glass and cut the inside curve first. It is sometimes necessary to make several radial cuts and take out the inside in several pieces. In cutting the outside, be sure to make a good clean cut at both points so they will not break off.

The orange-red color of the moon may be obtained by coating the glass with a

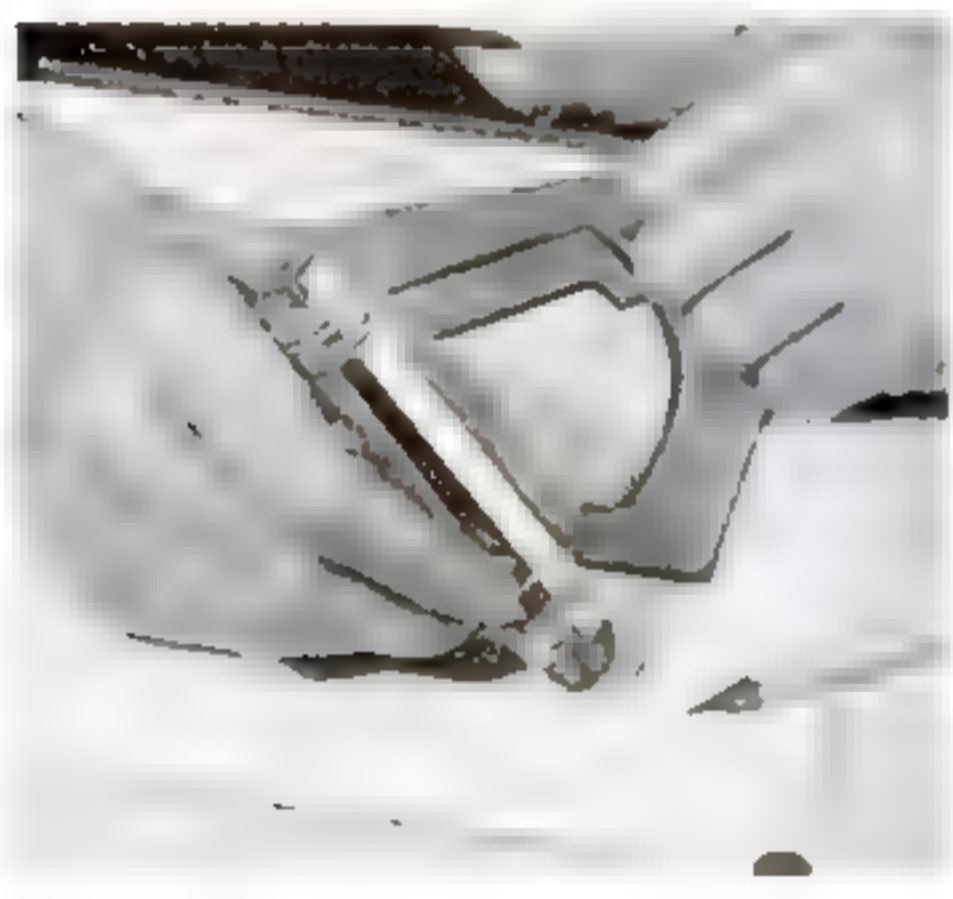
dye made for coloring lamp bulbs, by covering it with several thicknesses of transparent cellulose wrapping material, or, easiest of all, by using orange-colored paper, cemented around the edges with clear cement.

When the wiring is in place and the bulbs have been tested, the glass front is slipped into the grooved edge of the tin; then the tips are closed over and crimped with a pair of pliers.

The base and post may be left natural or stained to match the furniture and finished with varnish. The moon is enameled black on the back and over the tin.

The owl is cut on the jig saw, shaped with a router on the drill press, and smoothed with a small dowel covered with sandpaper. The eyes are beads or large-headed tacks. Use a brown enamel, and touch up the shadows with black and the breast and throat with white.

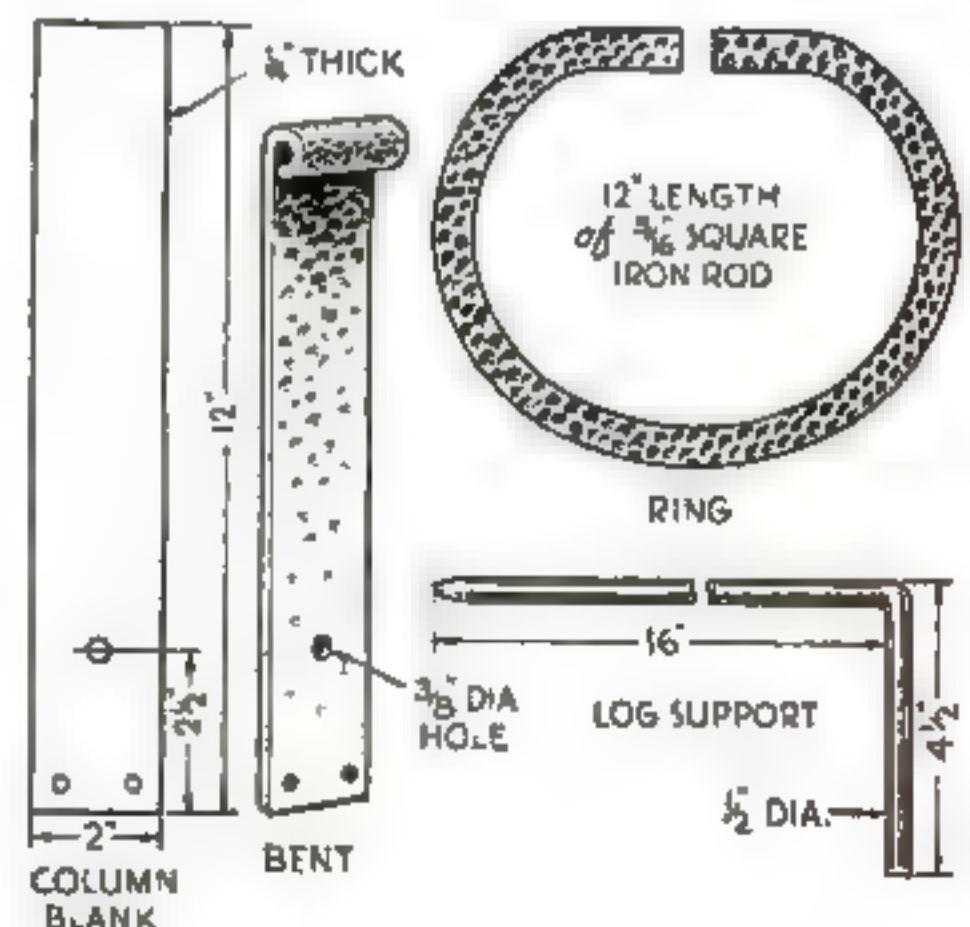
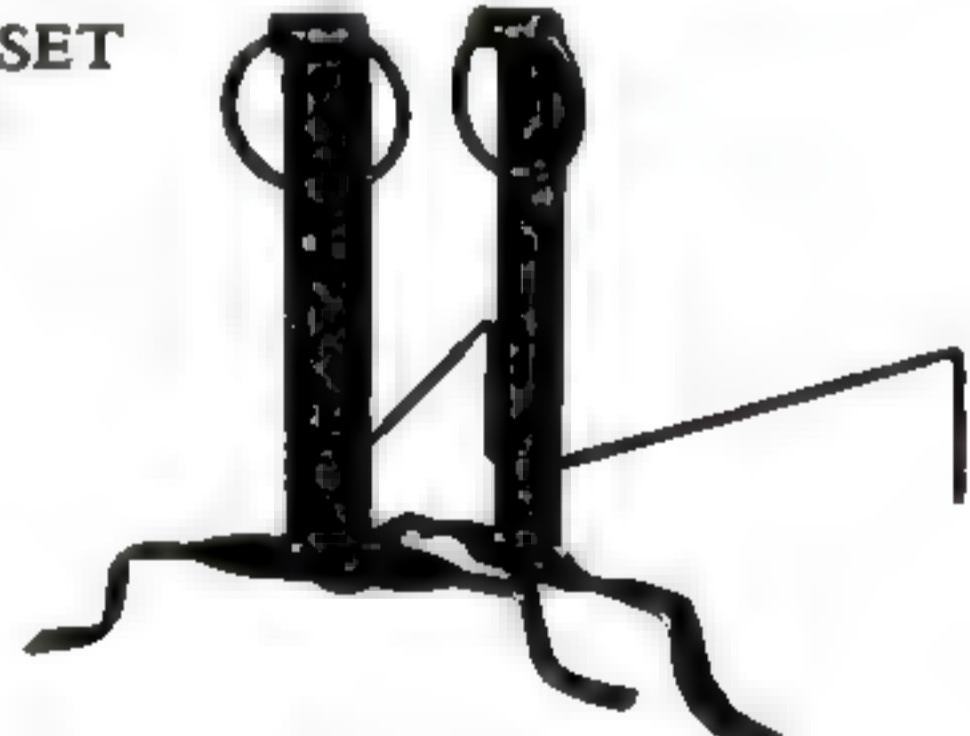
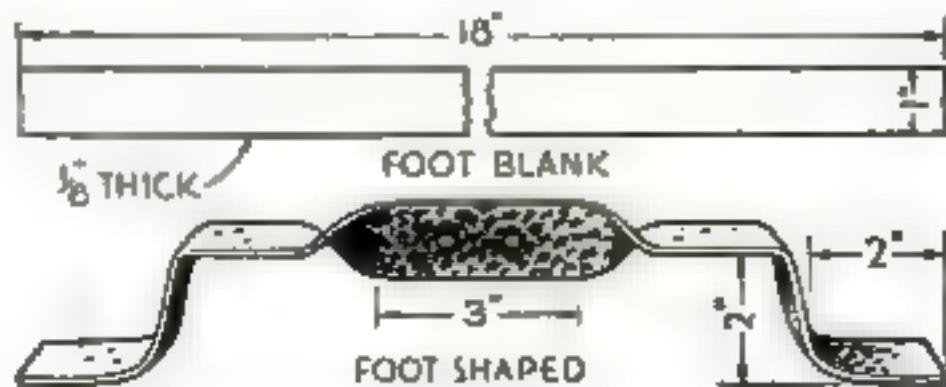
When the varnish on the base and post is dry, rub it down with pumice stone and oil. The owl is fastened to the moon with a small nail through the tail, where it projects down behind the horn of the moon, into the plywood.—D. C. MARSHALL.



HAND-WROUGHT ANDIRON SET MADE WITHOUT A FORGE

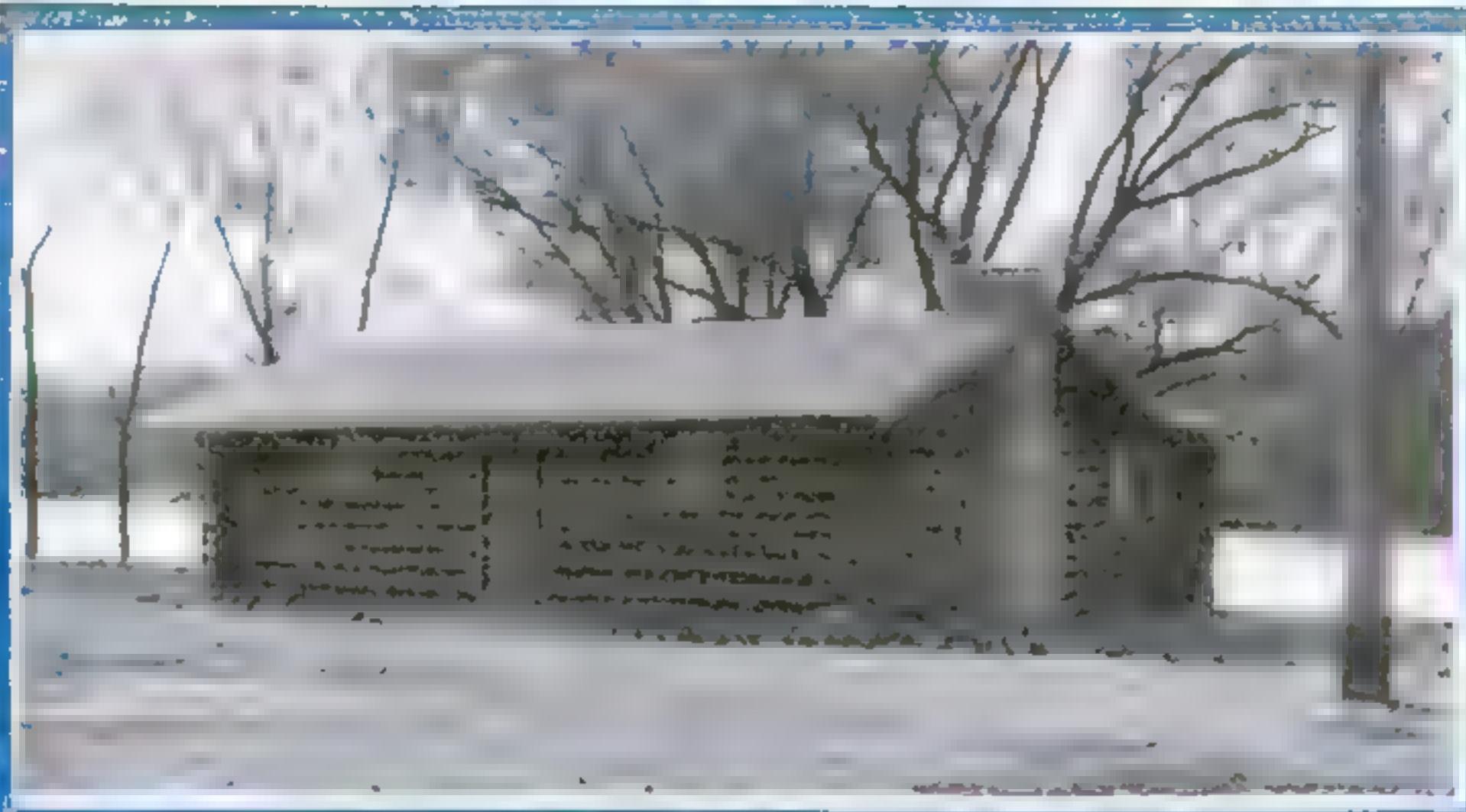
ALTHOUGH so light they can be made without a forge, these andirons are serviceable and attractive. Heat one end of each column blank to a white heat in the furnace, and with the aid of the vise and a hammer, form a loop as indicated. Then hammer the pieces all over and drill as shown. Form two rings (cold) from 12-in. bars of $\frac{5}{16}$ -in. square rod, insert in the loops, and drive the ends together.

In making the feet, a 3-in. length in the center of each is bent up at a right angle by placing the stock in the vise and twisting it with a monkey wrench. Then bend the feet to the shape indicated. Two holes are drilled, and the foot is fastened to the column with iron rivets. The log supports are $\frac{1}{2}$ -in. round iron with $4\frac{1}{2}$ in. bent down for the leg. The other end is tapered with a file, inserted in the hole in the column, and headed over.—R. J. HUGHES.

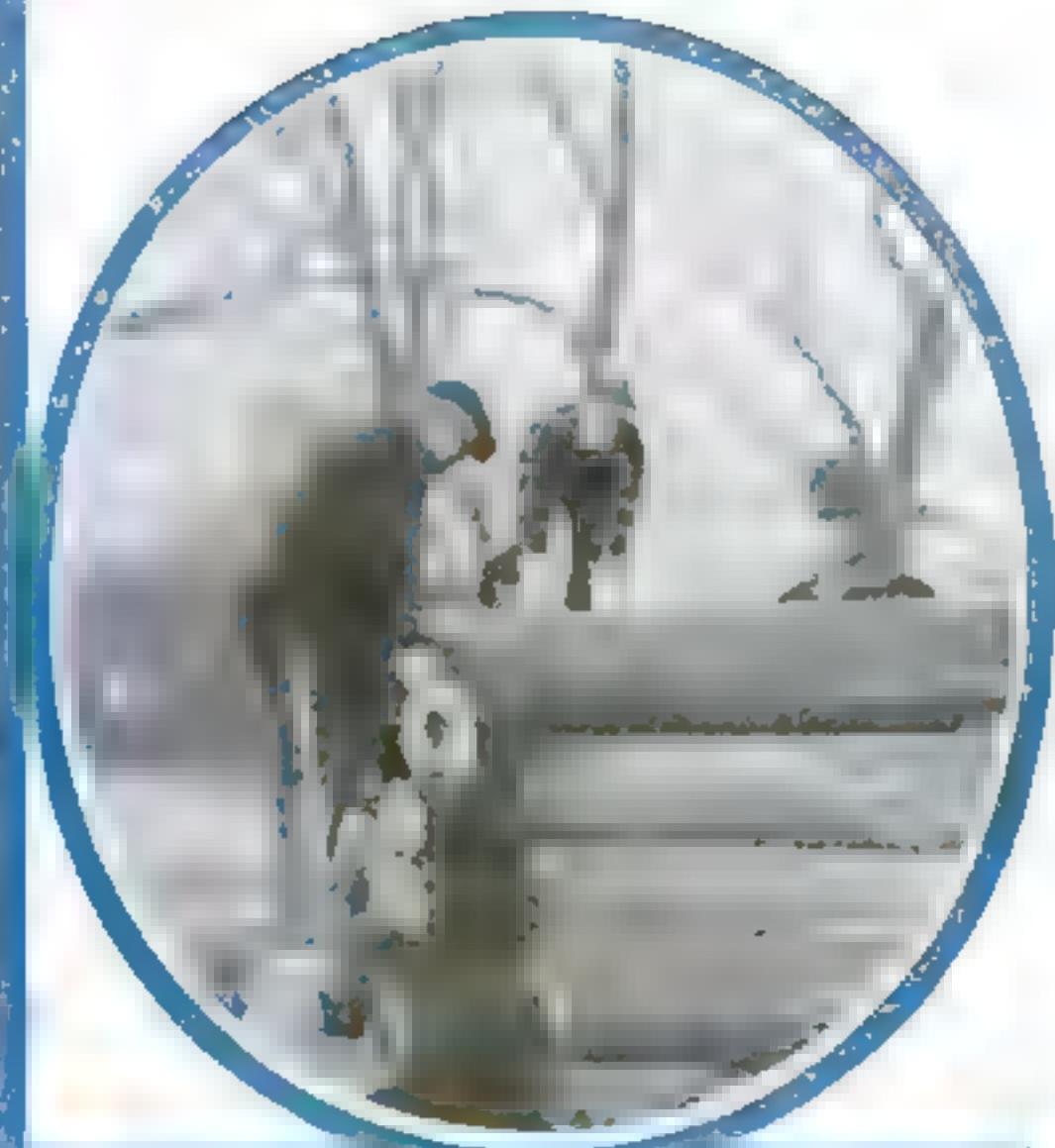


HOLDER GIVES FIRM GRIP ON SHORT ERASERS

WHENEVER much erasing has to be done on drawings, it is tiresome to use an ordinary small eraser because one's fingers quickly become cramped. This is an unnecessary hardship because an eraser holder that gives a firm grip on short erasers without tiring the hand can be made from two small pieces of angle stock or any scrap metal bent to an L-shape as shown above. Several rubber bands clamp the angles tightly against the square pieces of eraser at each end.—MAX CHARLES PRICE.



As a contribution to their community, the Rockford (Ill.) Homemcraft Club built this log cabin for the use of local Scout troops. At right: The cabin under construction.



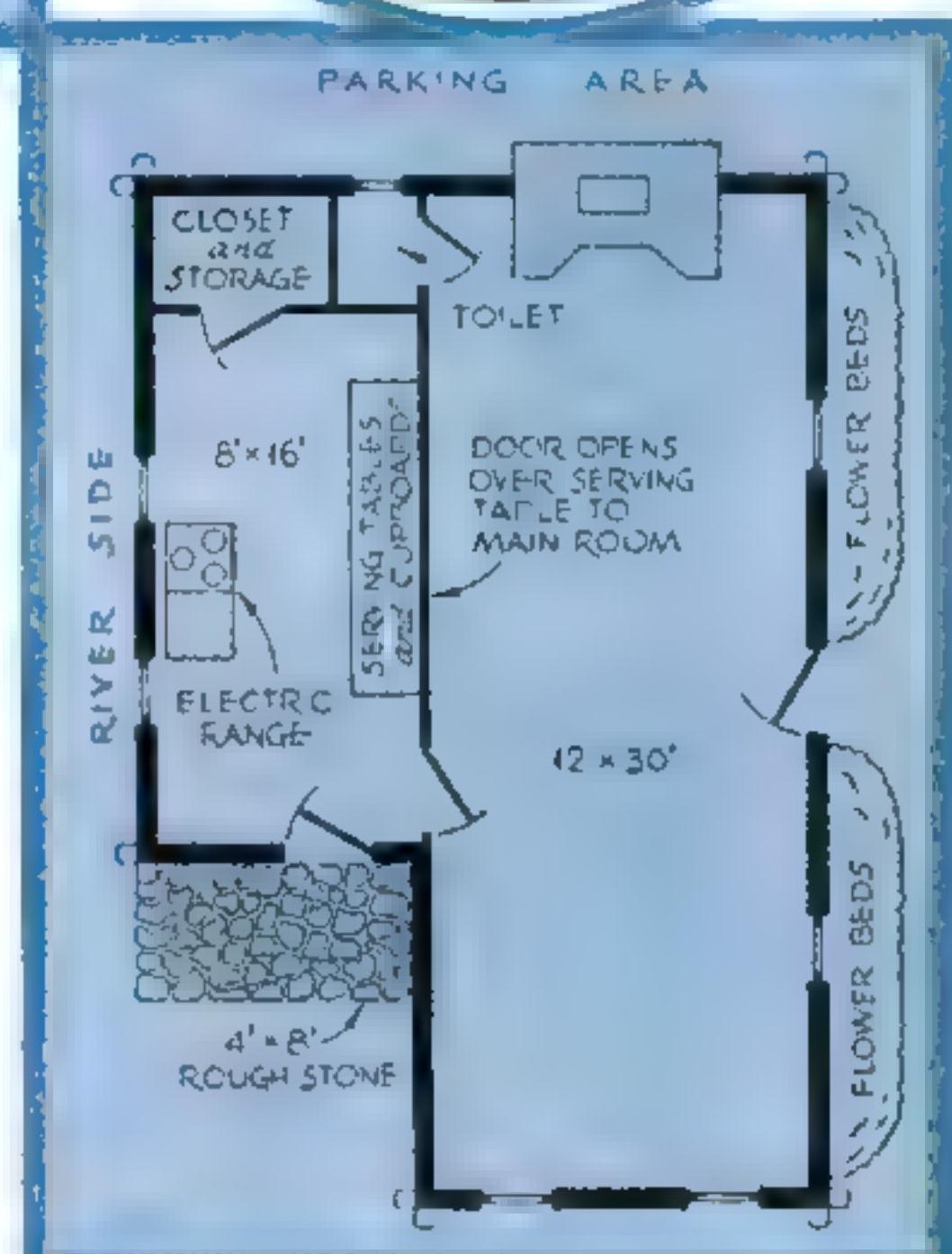
You, Too, Can Share in Splendid Work of **GUILD CLUBS**

GAATHERED in front of a log cabin they had built themselves, members of the Rockford (Ill.) Homemcraft Club recently presented it to the local Boy Scout organization to be used as a meeting place. Out on the Pacific Coast the Newcastle (Calif.) Homeworkshop Club has been distributing toys to crippled children and other shut-ins. In West Lynn, Mass., the Orchard Park Club is conducting a vocational guidance program for young people. Once a week in Fort Wayne, Ind., and vicinity, radio listeners hear interesting and informative talks about various phases of the home

workshop hobby as presented by the Civic Homeworkshop Club. During the past few months clubs in Saginaw, Mich., Ocala, Fla., Fall River, Mass., Denver, Colo., Creston, Iowa, and many other towns have been making toys to give to needy children at Christmas.

These are only a few of the many activities in which home workshop clubs are participating. If you would like to share in this great movement and work with other persons interested in the same hobby, in this way becoming a moving force in your community, you can do it simply by organizing a home workshop club among your own friends and neighbors. You will get a lot out of it yourself, too, because the association with other amateur craftsmen will encourage you to do more and better work.

Provided you have the necessary enthusiasm, you can start a live-wire club without the slightest difficulty. No experience is needed. The National Homeworkshop Guild has prepared a special bulletin that tells exactly how to go about it. Complete information is given on how to obtain names of prospective members, where to hold meetings, how to call and conduct meetings, how to insure good publicity, and how to prepare the constitution and by-laws. No charge is made for this. You can have the bulletin and an application blank for a charter merely by sending a stamped, self-addressed envelope to



A plan of the cabin showing the large meeting room and kitchen. For other details, see page 98.

Guild headquarters with the accompanying coupon. The National Guild is a strictly non-commercial organization. It charges no dues and provides its many services free to all affiliated clubs (see P. S. M., Nov. '36, p. 69). Affiliate cards for 1937 have just been issued and are ready for distribution to all clubs.

Turn to page 98 for reports from Guild clubs. POPULAR SCIENCE MONTHLY, the official Guild magazine, publishes news of all important home workshop club activities.

National Homeworkshop Guild 347 Fourth Avenue, New York

Please send me your special bulletin telling how I can organize a home workshop club in my neighborhood. I am anxious to join this national movement and would like to know all the particulars.

I am inclosing a large (legal-size) envelope, self-addressed and bearing a three-cent stamp for your use in sending me this material.

NAME _____

ADDRESS _____

CITY _____ STATE _____
(Please print very clearly)

WHITTLING NIGHT ...Club Feature for January



AS THE second in its series of monthly features for Guild clubs, the Program Service Bureau has arranged an instructive and entertaining program on whittling to be held in January. Full details have already been sent the secretary of each club. When the designated meeting night arrives, each member will be given a block of wood and allotted a definite period in which to carve anything that his imagination dictates.

The designing of an original three-hour project, to be built from materials costing not more than one dollar, is the feature for December (see P. S. M., Dec. '36, p. 67). Cash prizes totaling \$100 and three plaques will be awarded.

JOIN THE NATIONAL HOMEWORKSHOP GUILD

Tree-Shaped Nut Bowl and TURNED AND CARVED TABLE ORNAMENT

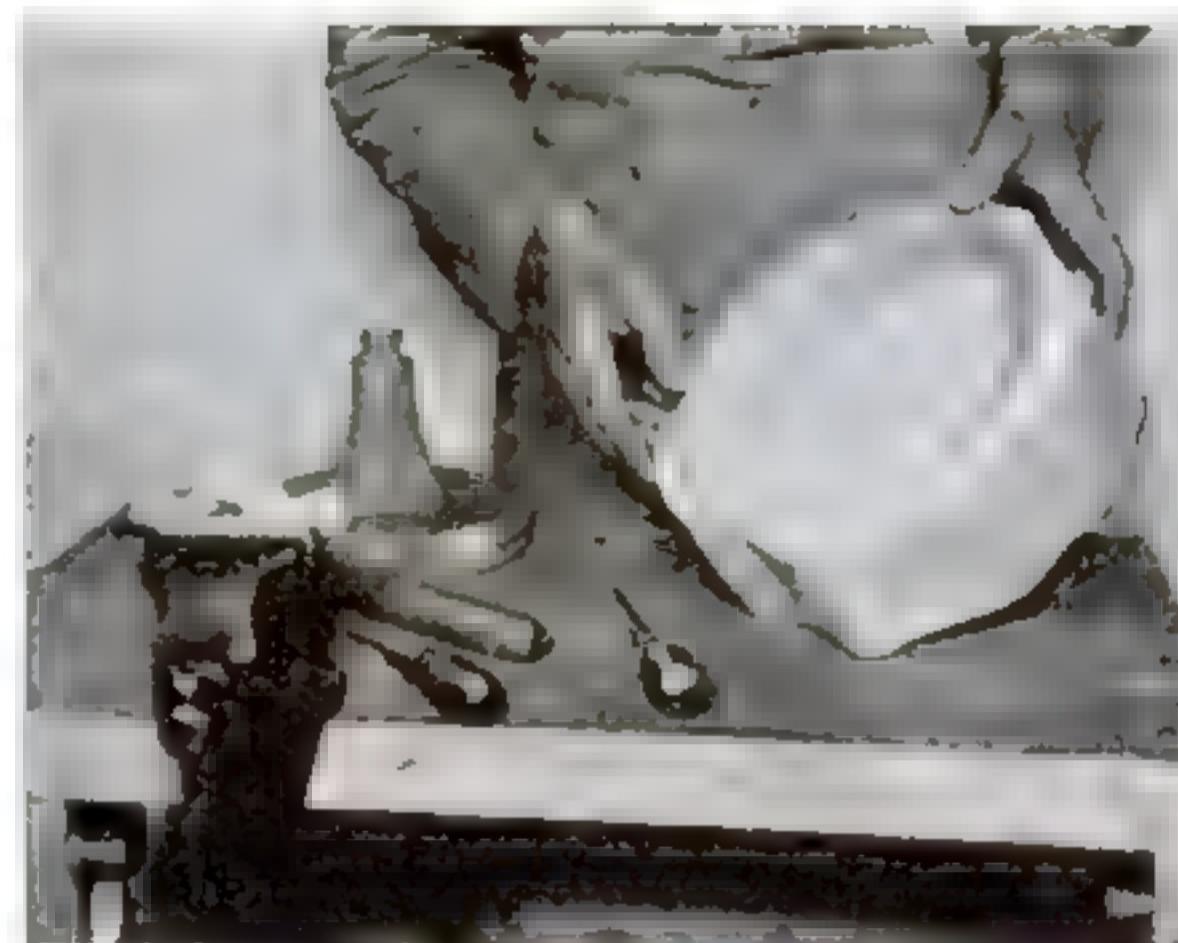


The outside of the bowl is carved to represent foliage, and the support to look like the trunk of a tree. Squirrels decorate the lower part

SQUIRRELS are always thought of as hunting nuts in trees, and this association of ideas is carried out in the nut bowl illustrated. It is made in the shape of a tree with squirrels playing around the trunk.

The base may be turned from walnut or whatever wood is available for the project. To make the tree trunk, use a piece 3 by 3 by 5 in., but do not turn down the large end more than shown—just take off the corners. Leave the trunk rough and when the turning is finished, place it on a bench and rasp the flat sides of the big end to form curves between the roots. Now turn the rasp crosswise and gouge irregular ridges to represent the bark. Use a stiff wire brush to remove all loose wood fibers.

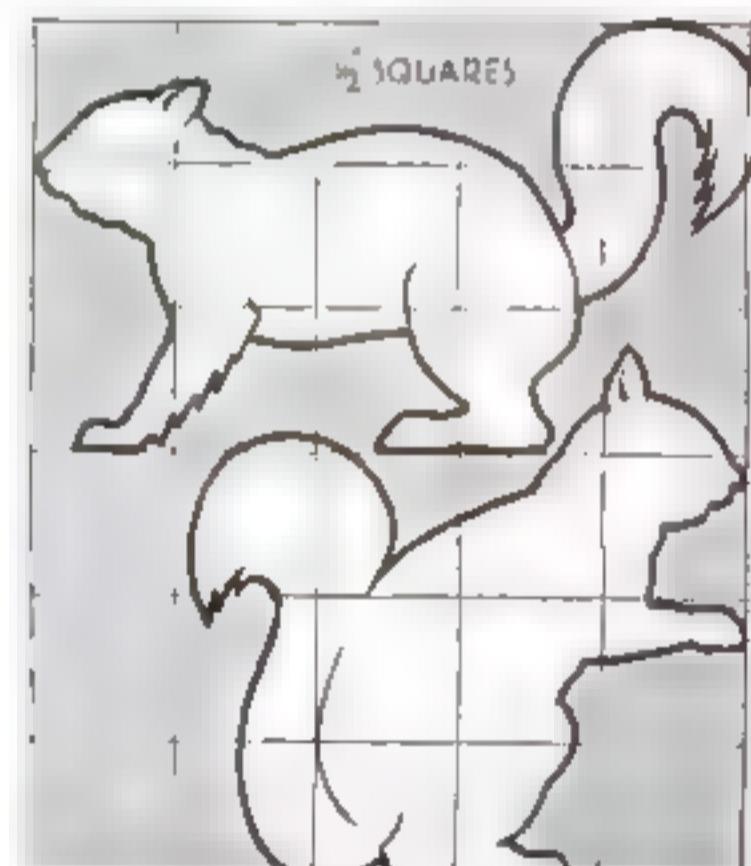
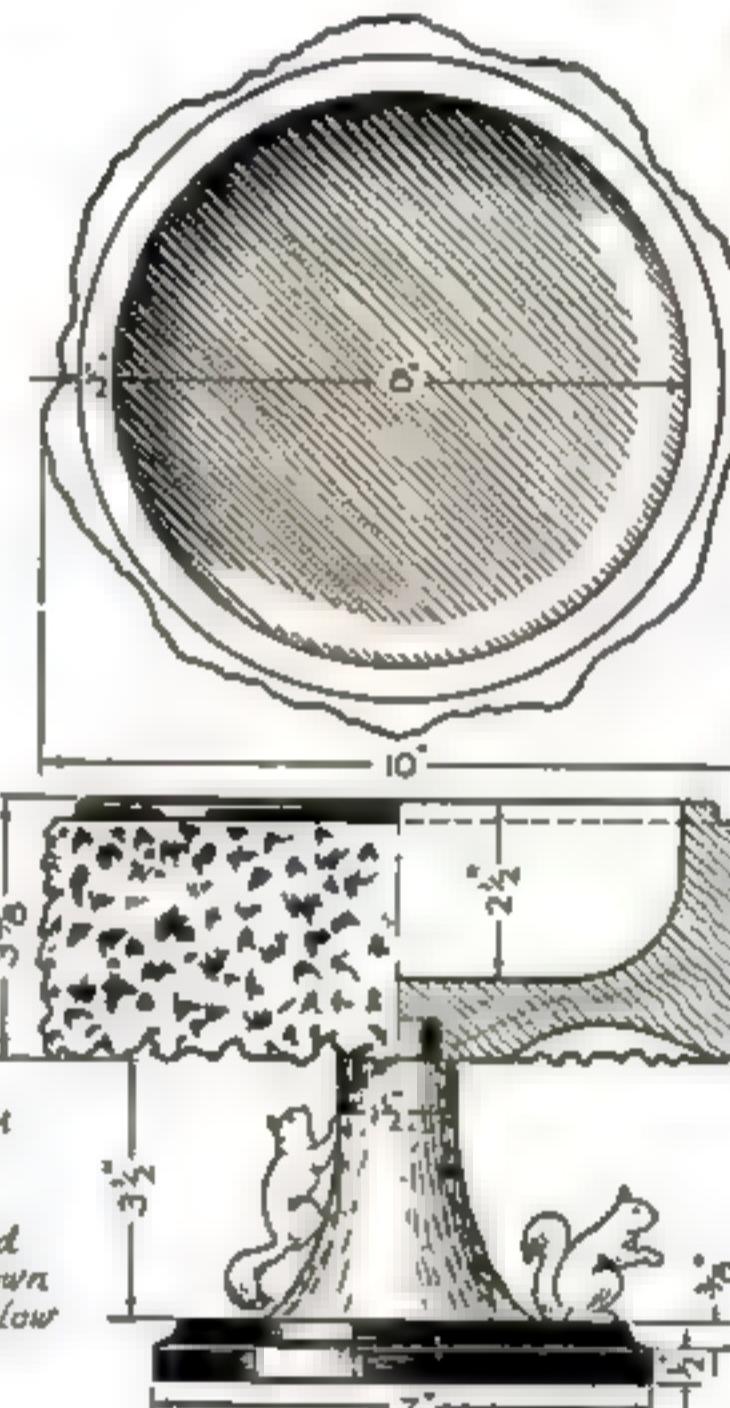
The bowl is made of two pieces 2 by 10 by 10 in. glued together face to face, unless you can get a piece 4 in. thick. A 10-in. circle is marked on the face, and the block is cut on the band saw. Fasten it to the lathe faceplate by screws into the bottom of the bowl. The inside is turned and the little rim around the top shaped up, but the outside is not turned. Now change the tool rest and undercut the bottom around the outer edge as shown. The inside is then (*Continued on page 86*)



To save work in carving, the outside of the bowl is band-sawed as shown at the left. Only the inside and top are turned on the lathe



The curves between the roots of the tree trunk and also the bark are worked out quickly by using a rasp



The assembled bowl, partly cut away; top view of bowl and base; and patterns of squirrels in two positions

MODERN BOOK ENDS MADE OF SPRING BRASS

FOR holding three or four books, the modern one-piece metal rack illustrated has the advantage that it never slips or lets the books tip over as ordinary book ends are likely to do. The tension is not strong enough to mar an expensively bound volume, but is sufficient to hold the books in place.

The material required is a strip of 0.015-in. spring sheet brass $3\frac{1}{4}$ in. wide by 22 in. long. If, however, it is desired to hammer the piece, use 0.017-in. soft sheet brass, and hammer before bending. Hammering with a planishing hammer will produce a decorative finish and at the same time harden the brass to the necessary springiness.

Measure in 7 in. from each end of the stock, place the brass in the vise, and bend at right angles, as shown. Then roll the two ends tightly around a length of 1-in.

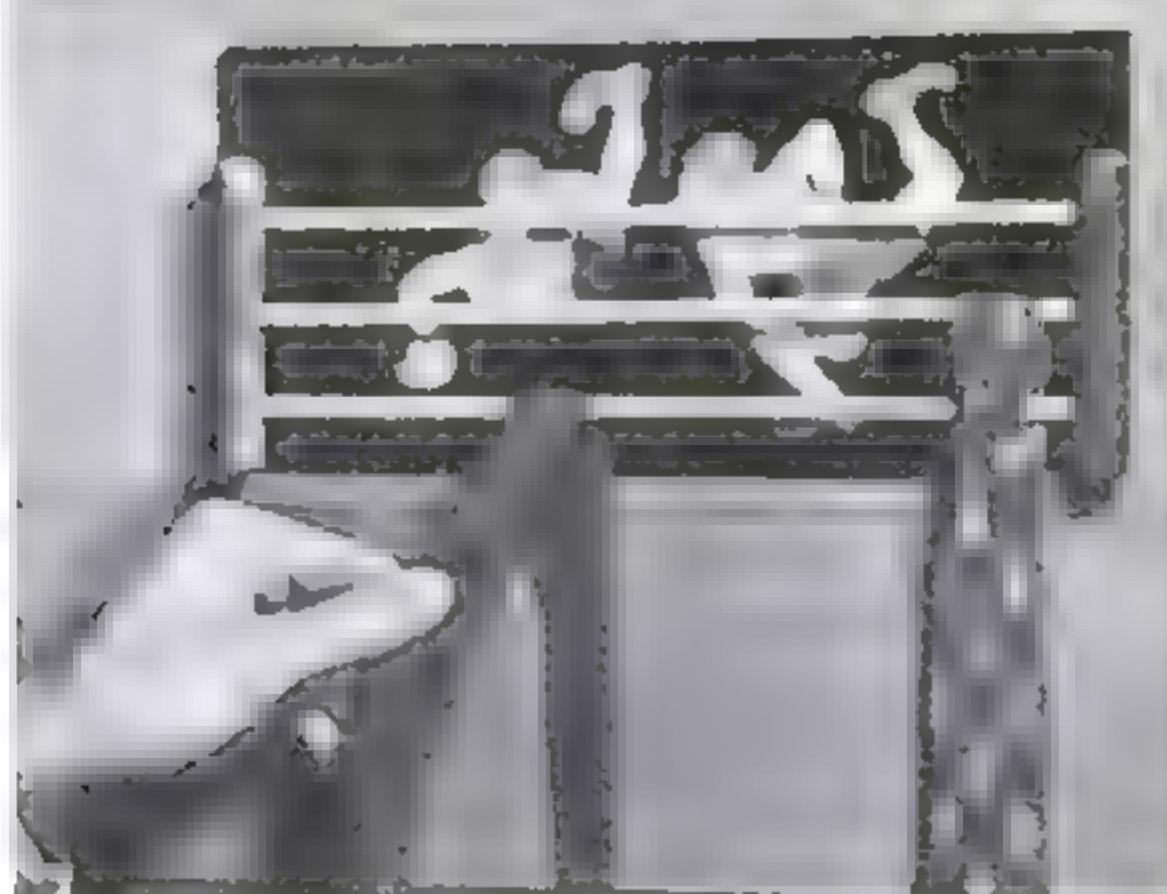


Beat from a single piece of spring brass 22 in. long, the rack will hold from one to four volumes

iron pipe. When released, they will roll back slightly, producing a spring roll of about $1\frac{3}{4}$ -in. diameter.

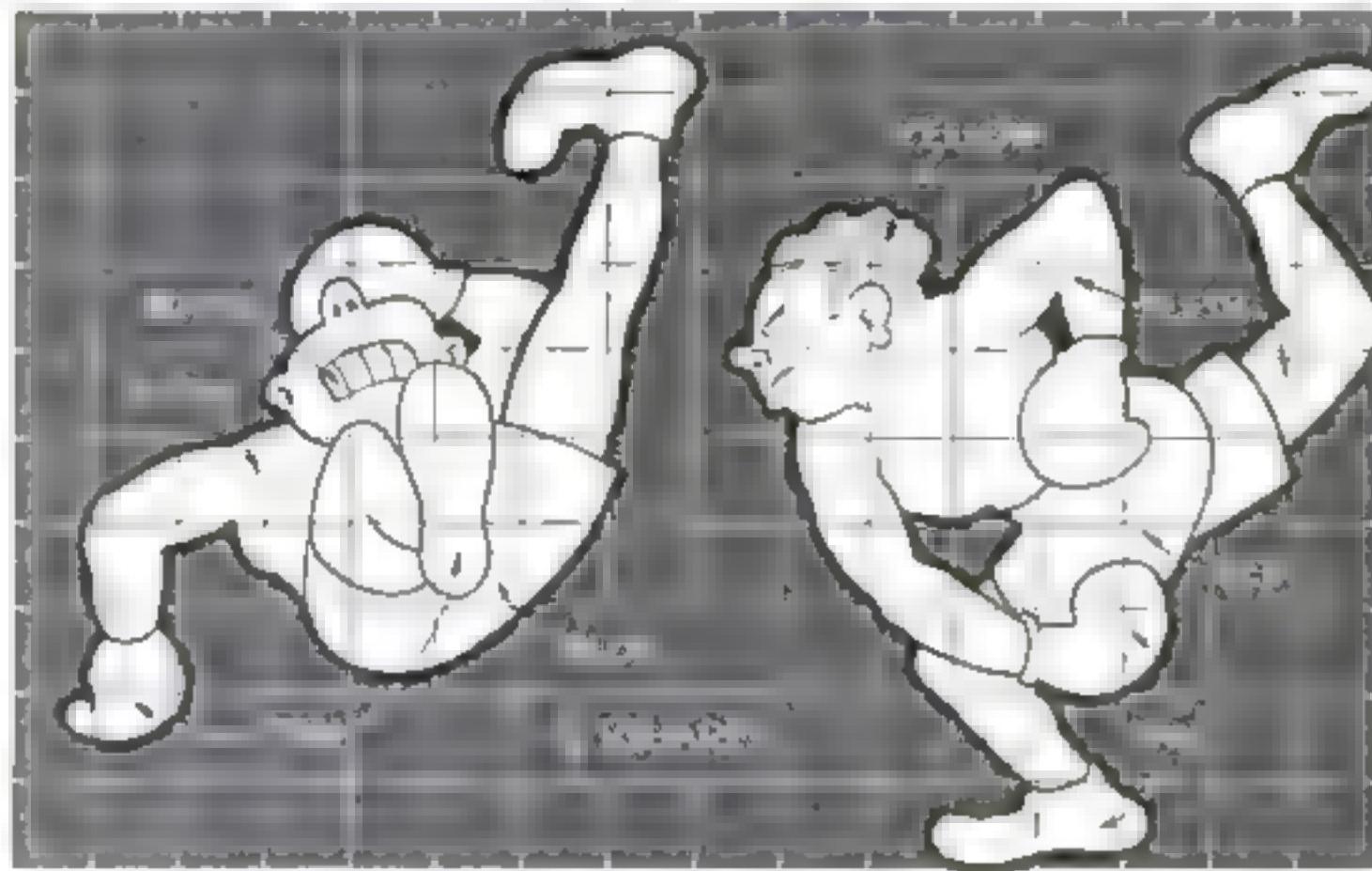
Polish the brass and protect with metal lacquer.—DICK HUTCHINSON.

Other Craftwork Novelties



The ties hang on the "ropes" of the ring, which are really dowels enameled white

Make full-size patterns for the figures by laying out $\frac{1}{2}$ -in. squares and drawing the outlines from point to point as in the copy



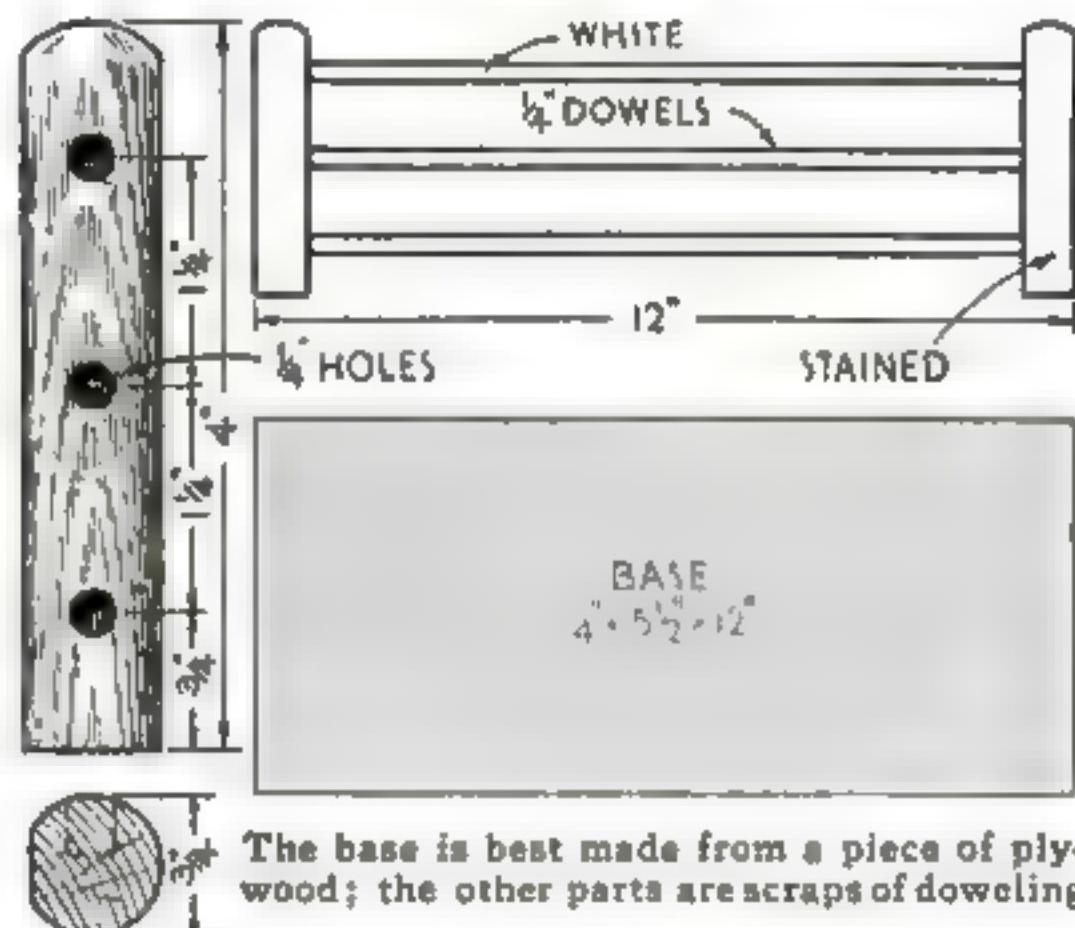
KNOCK-OUT DESIGN FOR A TIE RACK

THIS masculine tie rack is a welcome relief from the flowery variety usually found in the stores. A piece of $\frac{1}{4}$ -in. plywood, several scraps of dowel rod, and a little quick-drying enamel in various colors are the only materials required.

Cut the backpiece from the plywood. After squaring the edges, sand the entire piece and apply a coat of flat paint or prepared enamel undercoat. En-

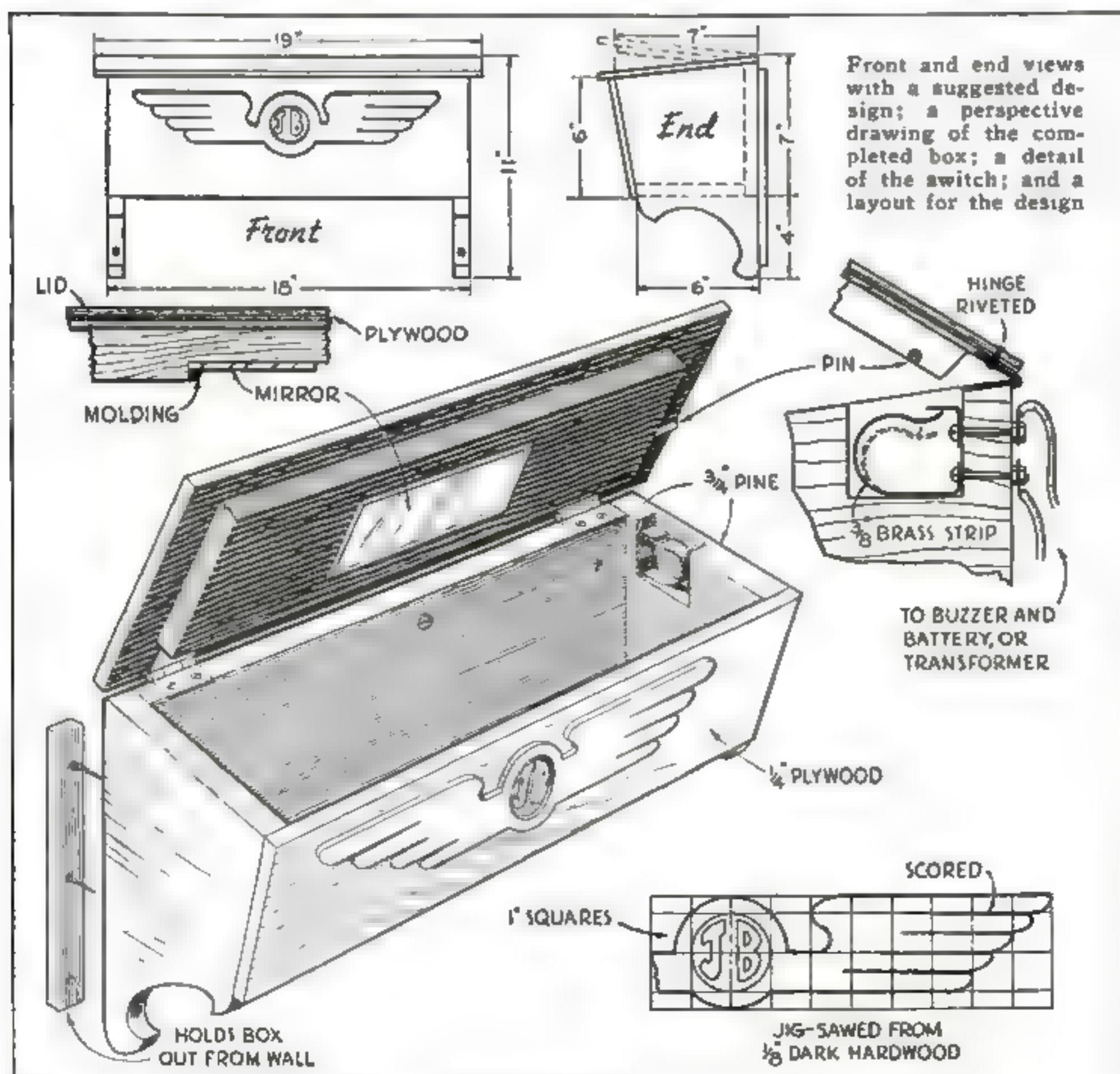
large the figures to the proper size, trace them on, and paint them, following the color scheme suggested or one of your own, as desired.

Make the corner posts from sections of $\frac{1}{4}$ -in. dowel. Glue the "ropes," which are pieces of $\frac{1}{4}$ -in. dowel, in place in the corner posts; then flatten the back of the posts slightly to facilitate mounting. Stain the corner posts and apply several coats of white enamel to the ropes. To assemble, brush a little glue on the flat portion of the posts, and drive a few brads into them from the back.—C. S.



The base is best made from a piece of plywood; the other parts are scraps of doweling

MAIL BOX ANNOUNCES POSTMAN BY RINGING A BUZZER



Front and end views with a suggested design; a perspective drawing of the completed box; a detail of the switch; and a layout for the design

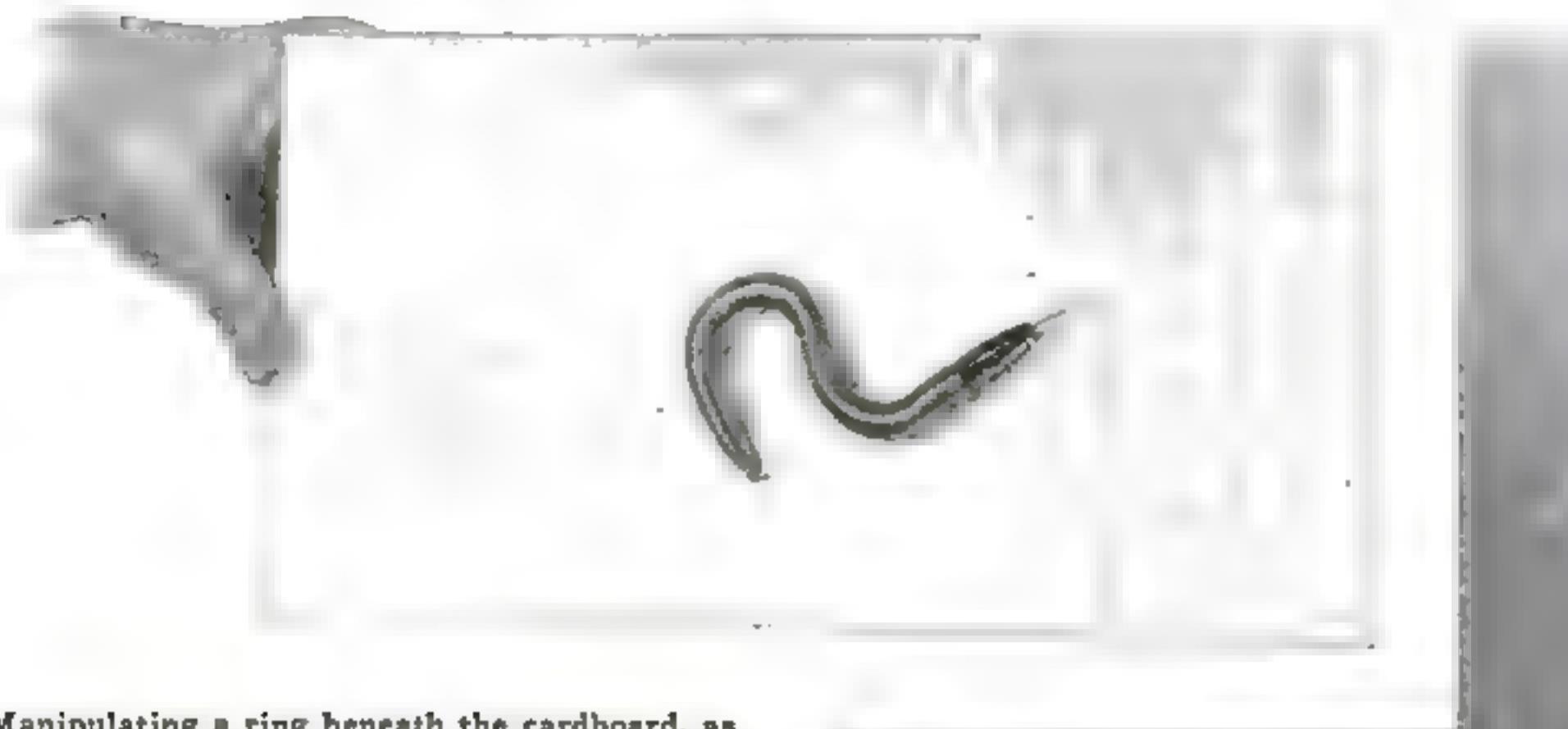
MANY useless trips to the mail box may be saved by installing a box like that illustrated, which rings a buzzer each time the lid is lifted. This not only announces the postman, but gives a warning should anyone attempt to meddle with the contents of the box. If desired, the box may also be placed breast high, out of the reach of mischievous small children, in which case a mirror is set in the lid to reflect the interior.

Pine and plywood are used in the construction, which is of the simplest type. The front may be embellished with a carved or scroll-sawed design, preferably in a hardwood darker than the background, if the box is to be finished in natural tones.

For the switch mechanism, a recess is made in one side and fitted with a strip of brass. This is kept from making an electrical contact by a pin, which depresses it when the switch is tested to your satisfaction, fasten wood or pasteboard over it to prevent long pieces of mail matter from throwing it out of adjustment. If the box is not shielded from the weather, be careful to protect the wiring adequately.

This type of box is intended to be attached to the side of the house or porch and is made unusually large to hold newspapers and magazines as well as letters. Of course, if your mail is light, the box need not be the full 19 in. wide, but can be shortened as desired.—H. SIBLEY.

Wire Snake Mystifies by Lifelike Action

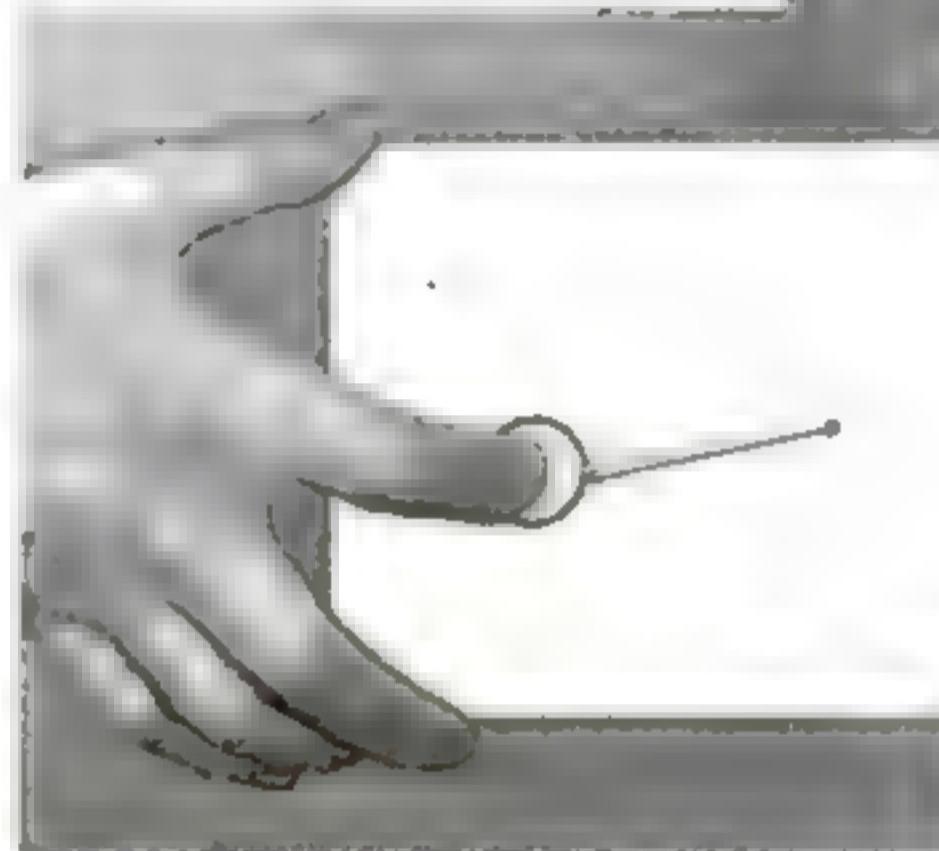


Manipulating a ring beneath the cardboard, as at the right, makes the snake coil and strike.

THIS mystifying little snake will startle your friends with its realistic coiling, striking, and wriggling. The only materials required are several feet of spring brass wire, a small drapery ring, cardboard, thread, and a piece of soft wood.

Since the diameter and the length of the snake may vary over a wide range, no dimensions will be given. Wind a number of turns of the wire on a tapered rod, bearing in mind that the closely wound coil will be approximately half as long as the extended coil required for the body of the snake. The winding may be facilitated by placing the tapered rod in a hand drill. The coil will expand somewhat in diameter when it is removed from the winding rod; for example, the snake illustrated was wound on a 3/16-in. rod and expanded to $\frac{1}{4}$ -in. when it was removed from the rod. Stretch the coil out to the desired length, but do not have the turns more than 1/16-in. apart.

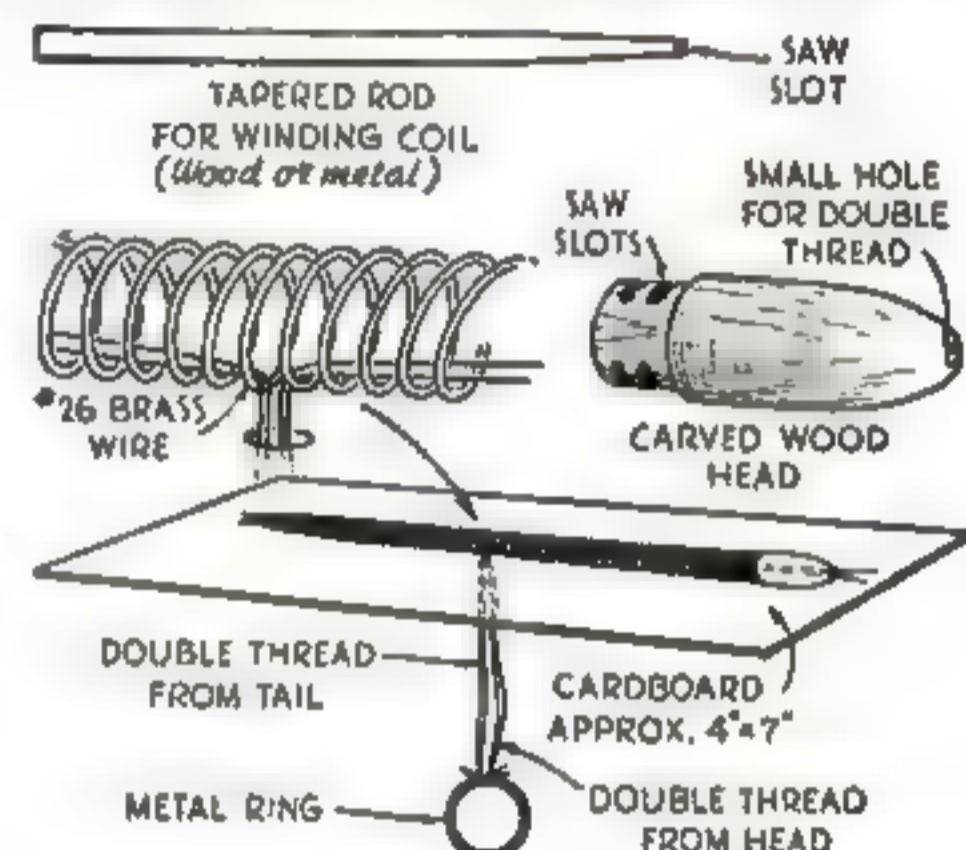
Carve the head from wood, as shown. Run a double thread from each end of the



coil and pass the ends through the coil at the center. Knot the thread at the tail, pass the thread at the opposite end through the head, and screw the slots of the head into place. Knot the thread at the head and leave a little extra length to serve as fangs. Pass the ends of the double threads through a small hole in a piece of cardboard and tie them to the ring. Hold the card in the hand and manipulate



The snake consists of a spring brass wire coil and a wooden head. Two double threads run inside from each end to the center, where they are carried out and down through the cardboard.



the ring with the first finger. After a little practice you will be able to make the snake coil and strike at will. If desired, the double threads may be attached to separate rings, so the head and tail portions are controlled separately.—KENDALL FORD.

POWERFUL METAL-CUTTING SHEAR BUILT FOR FIVE DOLLARS



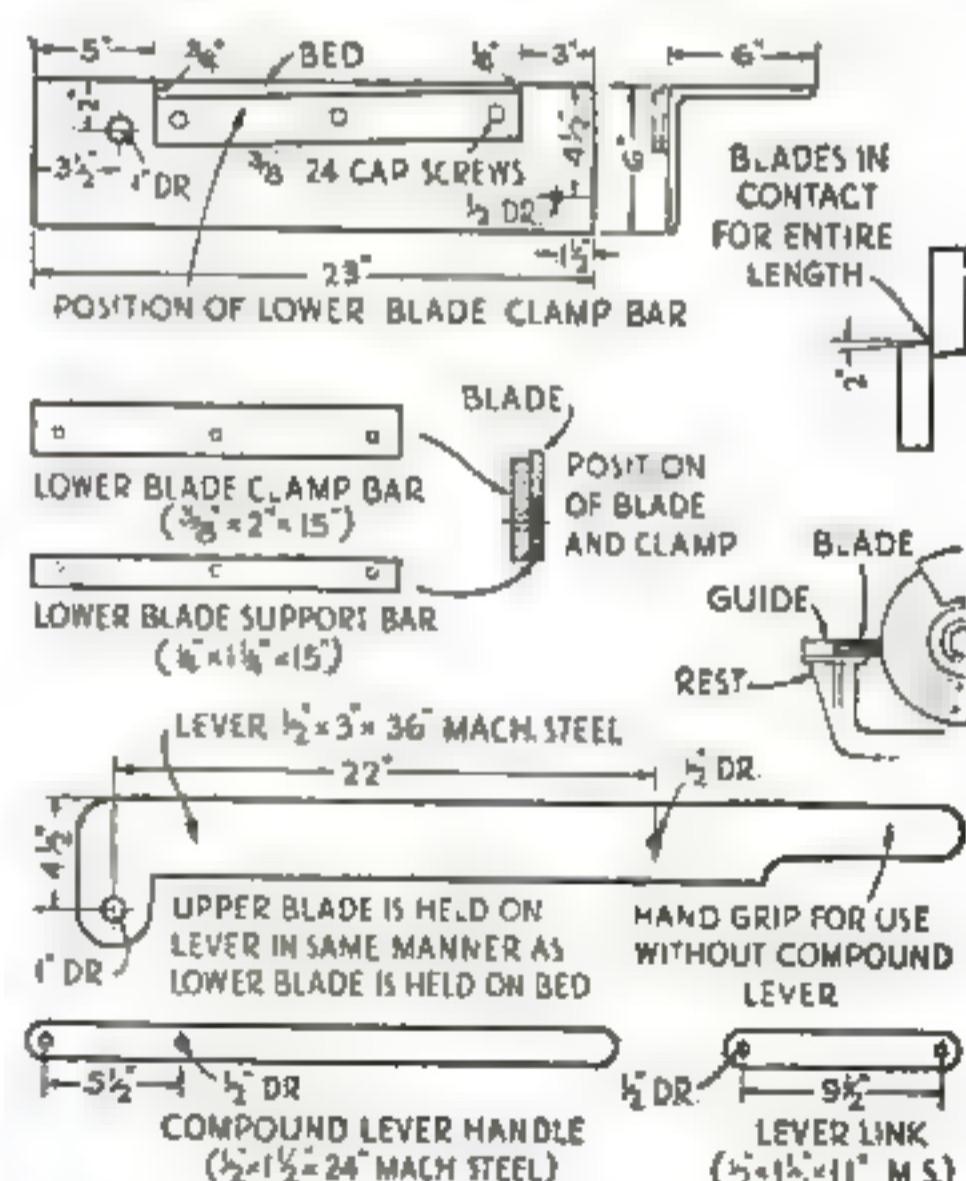
So strong is this square shear that it can cut steel plate up to $\frac{1}{2}$ in. thick. The piece shown in the photo above is of that thickness. At the right is a view of the main lever and, in the circle, a detail of the hinge



A SQUARE shear can be constructed for about five dollars by using worn-out planer blades for cutters. The one illustrated will cut steel plate up to 14 gauge by 15 in. wide, or $\frac{1}{8}$ -in. plate up to 6 in. wide. On light stock the compound lever may be disconnected for speed.

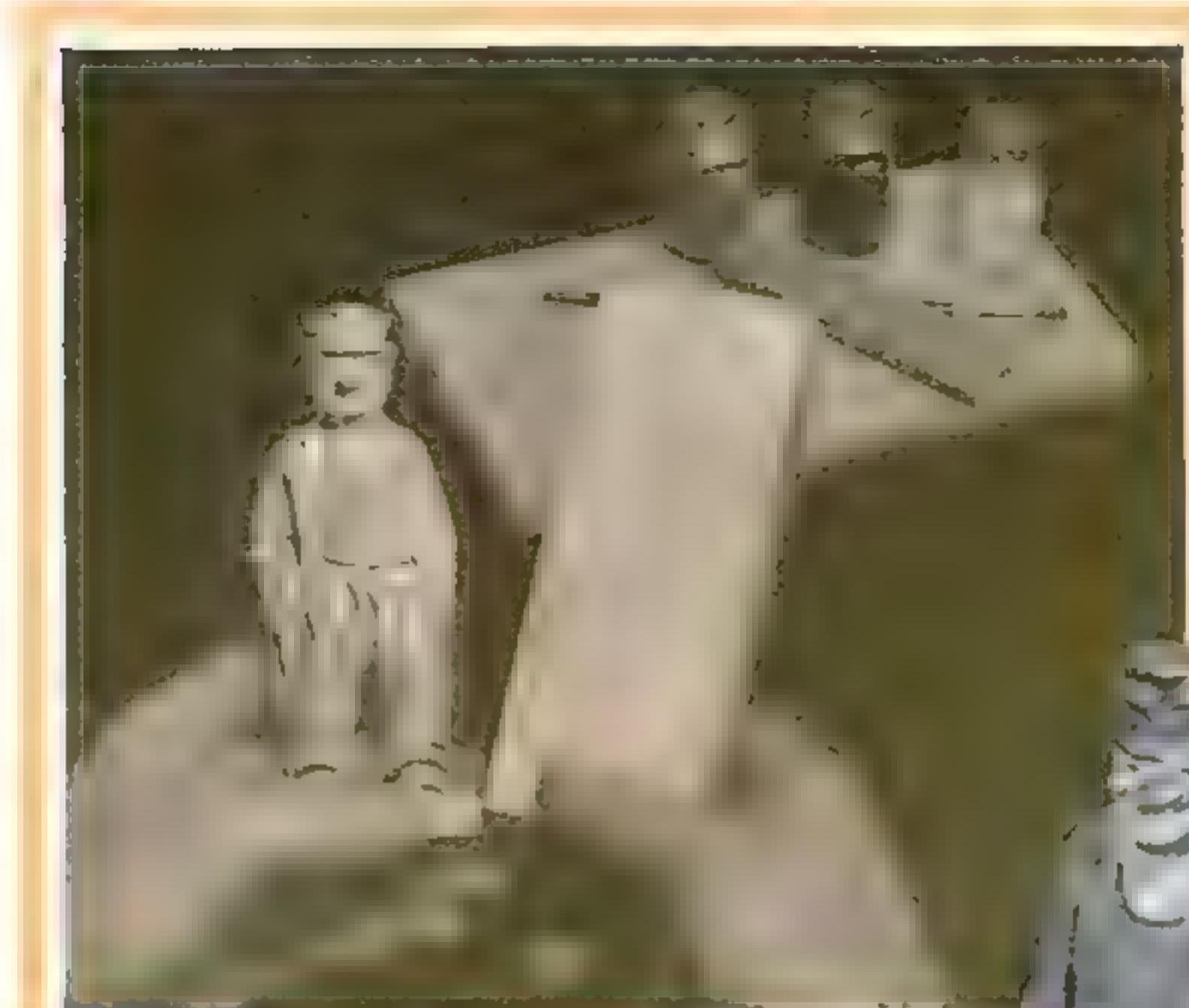
The accompanying diagrams need not be followed exactly except for the angle of the cutting blades. Old planer bits for making the blades may be had at almost any planing mill or sash-and-door factory. When grinding the blades, which are 15 in. long, it is best to set up a guide in order to get the correct angle and keep the edge straight. For cutting heavy stock, the

blades should be $\frac{1}{4}$ in. thick, but thinner blades may be used. It is essential that the blades pass each other very close together and be parallel.—W. C. CHENEY.



The main parts of the shear. Dimensions may be modified to suit the available materials

*A Fascinating
New Way to Learn to
Carve...The Model
Shows You Exactly
Where to Make Every
Knife Cut*



The new kit, at left, is unique in that a perfect replica of the carved figure is included. The materials may be used to make novelties like that below.



Hobo Hank

WHITTLING KIT

Contains Actual Figure to Copy

IF E. J. TANGERMAN, our whittling expert, could visit your home workshop for an hour or two, you wouldn't have any trouble in learning how to carve a figure like Hobo Hank. Since he can't do that, we have worked out something practically as good. We can send you a construction kit that contains a perfect reproduction of Hobo Hank, $5\frac{3}{4}$ in. high. Made of tough molded composition

and looking exactly like wood, the model reveals every single knife cut so you can copy it accurately. As a matter of fact, the figure is so perfect that when you are through using it to copy from, you can make it up into a novelty of some sort and, after it is stained or painted, few will be able to tell it from a hand-whittled job.

In addition to the model itself, the construction kit contains a selected white pine block 1 by $2\frac{1}{4}$ by $5\frac{3}{4}$ in. for whittling Hobo Hank; another piece of white pine $\frac{1}{2}$ by 5 by 9 in. for making accessories; bottles of red, white, and black paint; a brush, and a sharpening stone. With these

materials you can make a desk set, a pipe rack, a combination ash-tray and match or pipe holder, a book end, or various other novelties. Of course, you can use Hobo Hank alone, like our previous figures (Skipper Sam'l, Mère Marthe, and Gaspard) if you prefer, in which case you'll really have two figures—the one you whittle yourself and the one we send. The price of the complete kit is only \$1.50 postpaid. Please use the coupon on page 7, and don't delay if you want one of these sets.

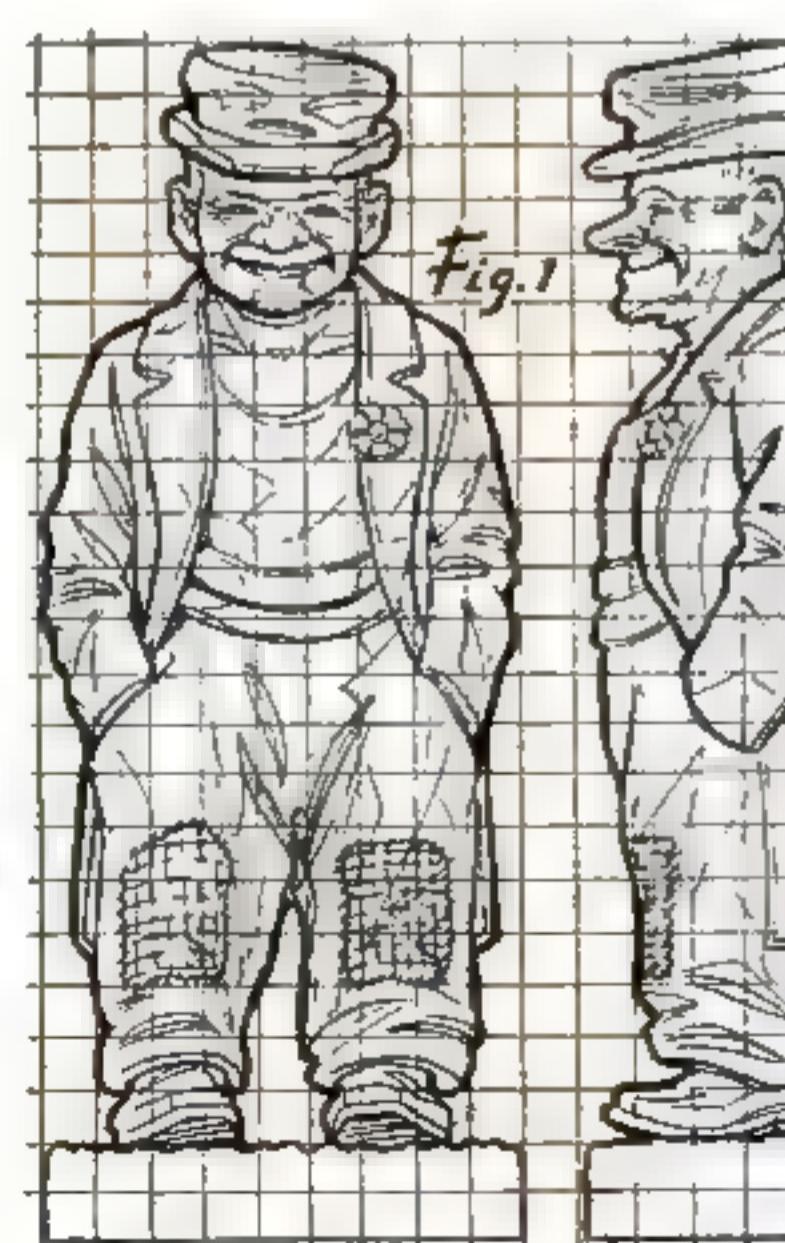
The first step in preparing the pine block is to saw it to the correct outline for the front of Hobo Hank (Fig. 1). Then roughly carve off the corners and

shape up the trousers and feet (Fig. 2). Hank is flat in back so he can stand against any surface. To get the arms right, sketch on the coat lapels (don't forget the flower); then cut straight down along their outside lines to within $\frac{1}{2}$ in. of the back. Make an outline cut along the inner edge of each lapel, and shape up the sweater and the trouser top with its supporting piece of rope. Cut the shoulders back and shape his coat collar and chin, as well as the low neck line.

Shape his battered hat, and go over arms, trousers and hat, putting in the creases. Put the (Continued on page 89)



Book end made by E. J. Tangerman. If you get our new kit, you can whittle a hobo for one book end and use the model figure for the other. At right: Front and side views and the roughed-out block.



Expert Advice on Keeping



Applying eggshell wall paint with a wide brush over the stipple coat. Note how brush is held for back stroking over the rough-finished wall

The color glaze is daubed on irregularly from the palette with a separate rag pounce for each color. The four pots of color are in the tray

After being pounced on to give a harmoniously fogged effect, the color areas are blended out with a dry brush—one brush for each color used

RALPH G. WARING tells: How to Repair and Refinish Interior Walls

IN MANY cases, the man of the house is confronted with the problem of re-decorating his living rooms, but does not feel equal to the expense of replastering old walls which have in part lost their keys back of the lath, or which have softened a trifle with increasing age.

If the style of the home is along Colonial or cottage lines—in fact, any style but the most formal Georgian—he is more or

less justified in using some form of extraneous coating that may be stippled or given a special surface treatment with the hand or palm, a wooden float, or a coarse brush or broom. These various treatments are in keeping with the general tone of the house, lead away from the severe harshness of troweled white plaster coats, and offer more light and shade. Fortunately, too, the various materials used in a stipple

coat may be readily applied and modeled by any careful home worker.

Before this can be undertaken, however, the walls must be made as mechanically sound as possible. Where the back plaster keys have broken off and the plaster shows signs of sagging slightly away from the lath, it will be necessary to use a number of $1\frac{1}{4}$ -in. No. 8 flathead bright wood screws with the *(Continued on page 92)*



The scaffold consists of movable supports and two planks

A ONE-MAN PORTABLE SCAFFOLD

NOT having extension ladders or ladder jacks, I made a good substitute as shown to enable me to paint and make repairs to a one-and-a-half-story house.

The planks are supported by what I call "scaffold jacks," made almost entirely of "two by fours." Each support consists of a 9-ft. upright with a short crosspiece at the top. A bracket, which projects 24 in., is bolted on 7 ft. from the ground and at such an angle that it is horizontal when the scaffold jack is leaned in place against the building. A 6-in. spike is

driven part way into the end of each upright and the head cut off, forming a point to prevent slipping. One or, if desired, two braces of 1 by 2-in. stock are bolted to each upright 3 ft. above the ground to prevent any side sway. The scaffold jacks are placed about 10 ft. apart and two planks $2\frac{1}{2}$ by 10 in. by 12 ft. are laid across the brackets.

The scaffold jacks may be built longer or shorter, as required. The planks could be secured to the brackets with C-clamps, if thought necessary, but I never found any tendency for the scaffold to tip even when standing at the extreme end. Burlap pads may be tacked to the top cross members to prevent scarring a first coat of paint while the second coat is being applied.—WILLIAM A. CARPENTER.

Your Home Shipshape

HAROLD P. STRAND *tells: How to Connect House Lighting Switches*

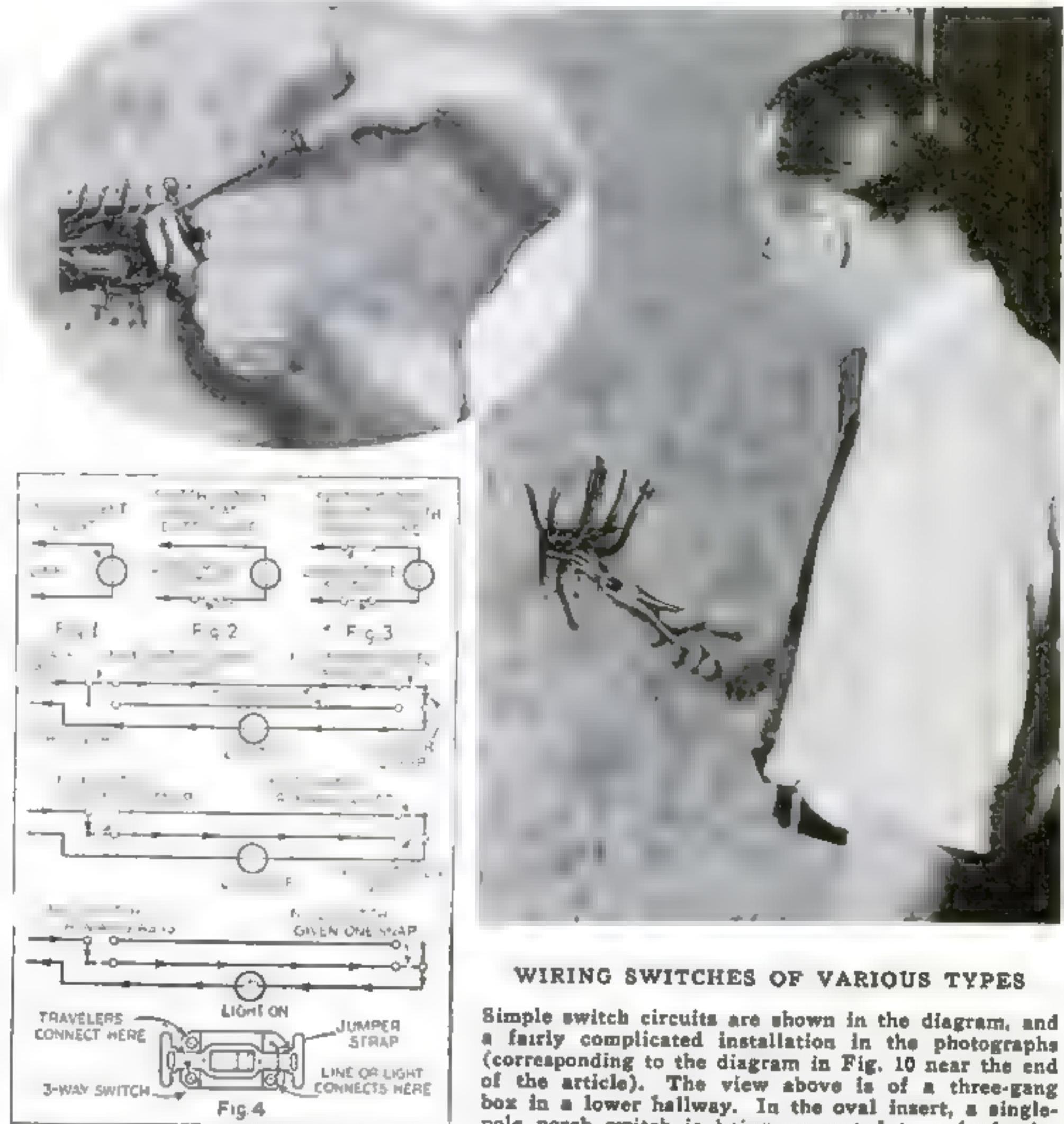
WATCH an electrician at work at a switch box containing a large number of wires. He selects certain ones, twists them into a pigtail splice, and connects others to the switch terminals. It seems mystifying, but there is really no mystery about it, and a brief study of the accompanying diagrams ought to make it clear to the handy man.

Starting with Fig. 1, we have what is known as an independent light connection. Two wires from the line are connected to the light and unless there is a pull chain or key socket on the fixture, the light will burn continuously. Independent lights are now getting obsolete in the modern home; most wiring plans call for every light to be controlled by a wall switch.

In Fig. 2 is shown a simple single-pole switch. This is the most common type and the easiest to wire. One wire runs to the light, the other line is connected to one side of the switch, and from the other side of the switch a wire connects to the other side of the lamp.

In some cases it may be desired to open and close both sides of the line. The double-pole switch shown in Fig. 3 will do just that. It is not considered a common type of house switch today, but may be found on certain types of appliances and in other special uses.

Switches for controlling hall lighting, garage lights, and lights in rooms having two entrances, are of the three-way type. In Fig. 4 is illustrated a three-way circuit with the switches in three positions. With the aid of the arrows, the path of the current may be traced. The drawing of the switch (*Continued on page 110*)



WIRING SWITCHES OF VARIOUS TYPES

Simple switch circuits are shown in the diagram, and a fairly complicated installation in the photographs (corresponding to the diagram in Fig. 10 near the end of the article). The view above is of a three-gang box in a lower hallway. In the oval insert, a single-pole porch switch is being connected to a feed wire

CAKE-ICING TOOL POINTS UP BRICKS

PPOINTING up brickwork is a slow and tedious task unless you do as one handy man did when faced with such a job. At a ten-cent store he bought a small aluminum cake-decorating set for applying icing in fancy shapes. A nozzle with a single small round opening was screwed on the gun, which was then filled with a prepared patching plaster suitable for such work. The plaster was mixed somewhat thinner than if a trowel were to be used.

After forcing the plaster into the joints, he allowed it to set for a moment, then wiped and smoothed the joints with his finger. What little excess spread on to the bricks was quickly removed with a small paintbrush wet with clean water.

Two things are important: Mix only a little plaster at a time, and stop as soon as you feel the mixture getting stiff in the gun, dump it out, and rinse the gun in a bucket of water to clean it thoroughly, otherwise it will get clogged with the hardened plaster.

Of course, before you mix up any plaster, it is necessary to clean out all the loose mortar and thoroughly saturate the joints with water, otherwise the new plaster won't stick.—E. C. CANOVA.



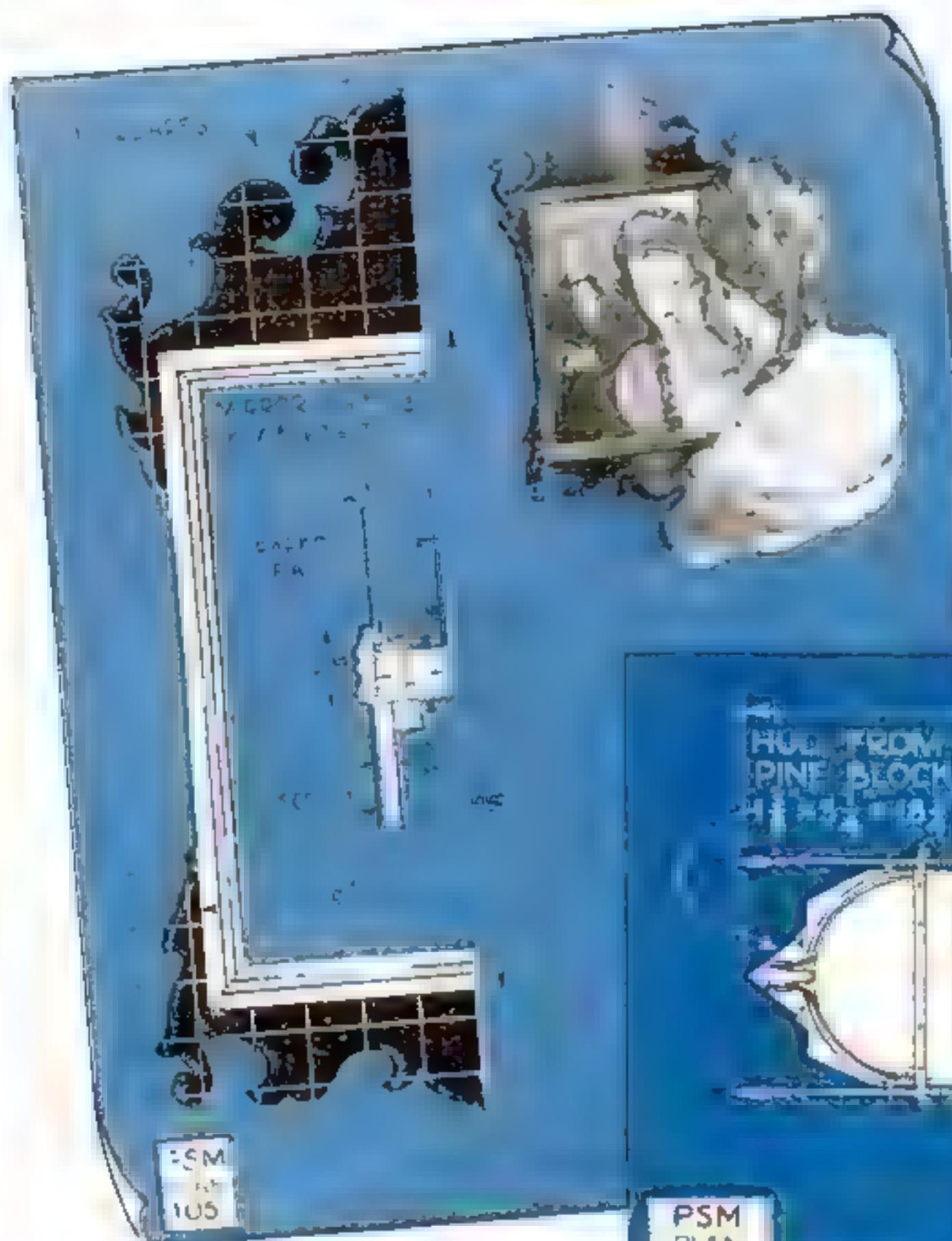
The prepared plaster is deposited neatly in the joints without smearing any on the bricks

A Check List of JANUARY JOBS

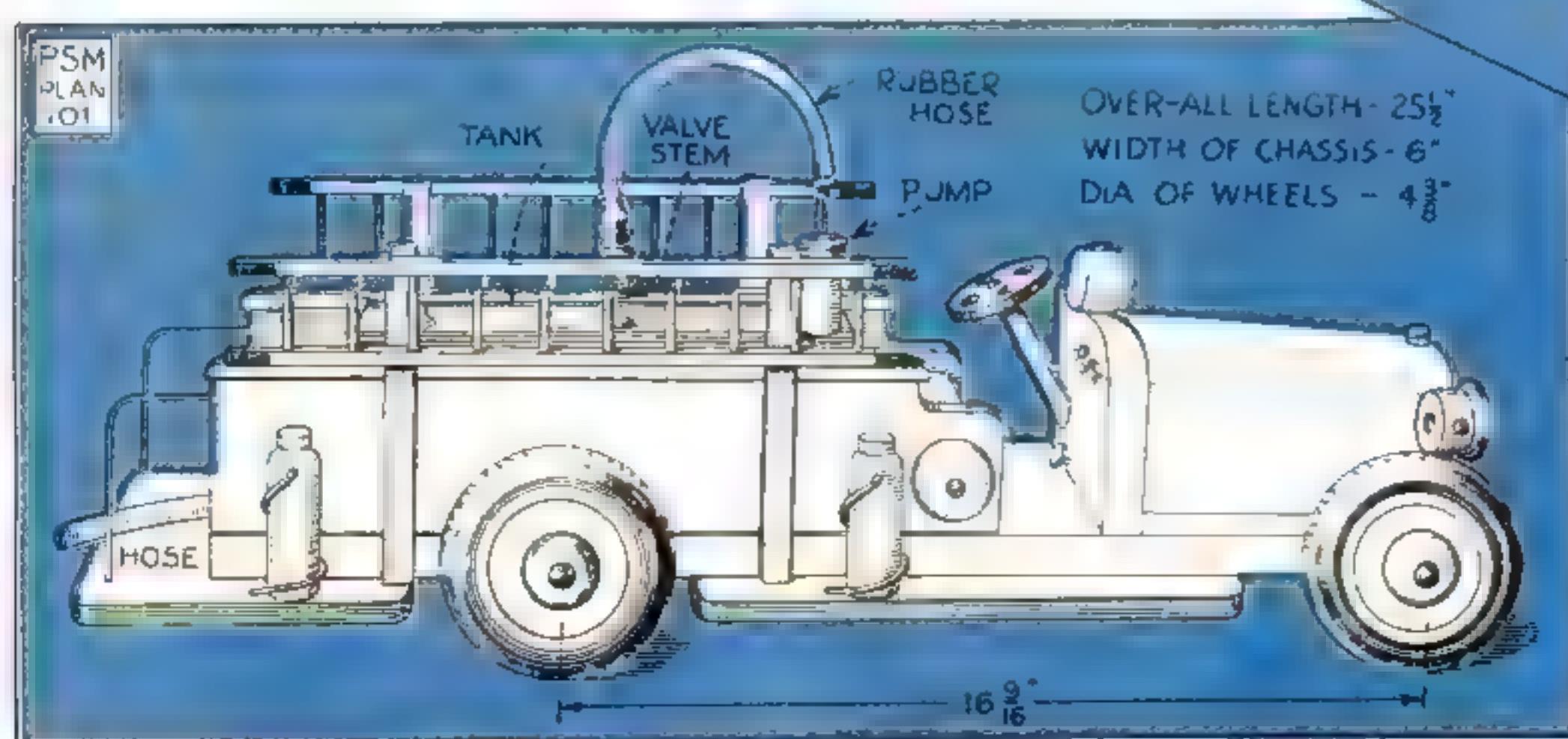
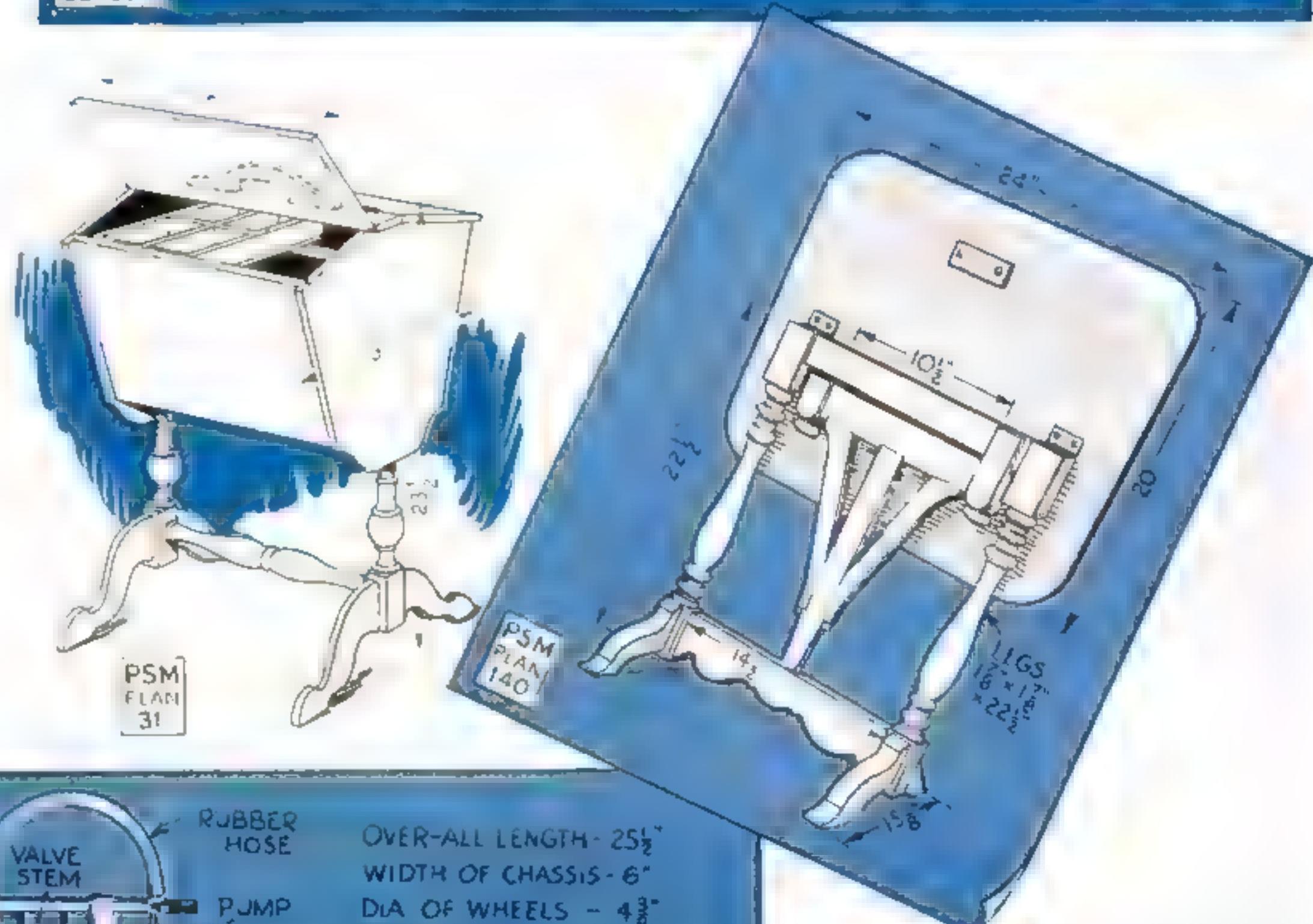
Why not start the year right by making some of those needed repairs around your house? There is always something that requires to be adjusted, improved, or modernized. Following are a dozen suggestions for January:

- Build recreation room in cellar or attic.
- Correct the heating of a cold room.
- Install concealed radio wiring.
- Repair leaky faucets.
- Replace defective window cords, pulleys, and latches.
- Refinish worn floors.
- Install radiator covers. Repack leaky valves.
- Line clothes closets with cedar.
- Check furnace oil burner for efficiency.
- Replace worn-out treads on stairs; investigate creaks.
- Adjust baseboard and molding moved out of position by settling.
- Eliminate pull cords on electric lights by installing adequate wall switches.

PLANS in BRIEF



MANY experienced home workers need little more than a sketch and a few over-all dimensions from which to work. Some of them, indeed, prefer to work out the details as they go along, because it gives their craftsmanship greater freedom and allows them to incorporate their own ideas and improvements. To give these readers a variety of projects from which to select, we are presenting a group of condensed plans. All of these projects have been redrawn from standard, large size, completely detailed blueprints in the regular POPULAR SCIENCE MONTHLY series. Five projects are illustrated here, and others will be given from time to time



In the group above are given designs for a walnut mirror of 1790, a Roman galley model which can be colored and gilded as gorgeously as you please, a mahogany or walnut sewing cabinet of the Priscilla type, and a rugged tilt-top table of oak

The toy fire engine at left is built around a rectangular half-gallon can and a bicycle pump. A good bicycle valve stem is used for the pump connection, and a stem without a valve is soldered at the rear for attaching the hose

YOU DON'T HAVE TO GO OUTSIDE TO READ THIS Electrical Thermometer

By
CHARLES
A. LAIRD

HAVEN'T you often wondered during a raging snowstorm how cold it was outside, yet hated to go out on the front porch to read the thermometer? Here is a home-made, remote-reading thermometer, called a "telethermometer" or "telethermoscope," that will give you the outside temperature while you sit comfortably in your room. It is similar to the type used by the United States Weather Bureau at many of its stations, and accurate to a fraction of a degree.

The following parts are required: a fairly sensitive galvanometer or 1-0-1 milliammeter, 30-ohm rheostat, dial with pointer, three 100-ohm wire-wound fixed resistors, push-button switch, three binding posts, 5-in. piece of brass or iron tubing of $\frac{1}{2}$ -in. inside diameter, a dry cell, and a box to contain the necessary wiring.

Temperature readings are obtained by measuring the resistance of a coil of fine copper wire to an electric current. According to a well-known principle of physics, metal changes its electrical resistance as the temperature of the metal changes. Platinum shows the greatest degree of change but is very expensive, therefore copper, which has somewhat the same characteristics, is used in this home-made indicator.

First wind the coil of No. 36 enamel-covered copper wire on a strip of mica or any thin insulating material $\frac{3}{8}$ by $3\frac{1}{2}$ in., as shown in Fig. 1. Solder leads on the ends of the wire and tape them to the strip to prevent breakage. This unit, called the "bulb," is then inserted in the metal tube, which has previously been lined with waxed paper, and sealed with hot wax, leaving the leads outside.

The indicator, which is merely a resistance-measuring unit known as a Wheatstone bridge, may be built in various ways. The box for this particular model is an alloy can commonly used in radio work, but a well-made wooden box would serve just as well. The galvanometer and indicating dial are set in the top panel, as are the switch and binding posts. Resistance coils, rheostat, wiring, and battery are contained in the box.

Figure 2 shows how the parts should be wired. The bulb is connected to the indicator by a three-wire lead. The extra wire is used to compensate for temperature changes in the lead wires so that only the temperature of the actual copper wire coil will be measured. The leads may be



The tube goes outdoors, and the temperature is read on the dial indoors. Below: Soldering a lead on the rheostat

mometer of known accuracy in a room where the temperature is quite high. The dial should be marked the same as before and the temperature noted. Do this for several changes in temperature and soon you will have enough marks on the dial to divide it into degrees of temperature. The accuracy that may be obtained in this way is surprising, and if your telethermoscope does not become accidentally damaged it will remain accurate for years.

The bulb may be placed in a small, ventilated box away from the house and connected with the indicator by a three-wire lead (No. 18 or larger). The indicator may be placed anywhere in the house. To learn the outside temperature, press the button and turn the dial until the meter shows zero. The pointer will then be at the correct temperature. Another dry cell may be added if it is desired to make the indicator more sensitive.

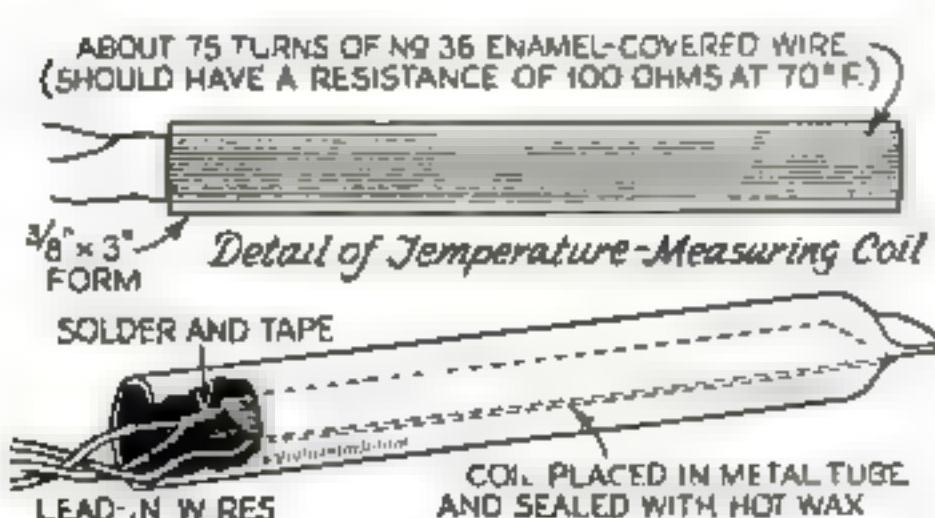


Fig. 1. Temperature-measuring coil or "bulb"

of any length required by the installation. After the parts are assembled, it is necessary to calibrate the dial—a simple operation. Place the bulb in a dish or pan of cracked ice and allow it to remain there several minutes. Press the button and watch the galvanometer needle. It will swing to one side of the center, showing that the bridge is out of balance. The dial should be turned until the needle points to zero, when the resistance of the bulb and that of the fixed resistor in series with the rheostat are the same. A mark should now be placed on the dial, even with the pointer. This is the point where 32 deg. will be on the dial and should be at about the center of the dial. If it is not, increase the resistance of resistor A in the diagram by putting about 2 in. of fine German silver wire in series with it. This may be varied until the freezing point comes about at the center of the dial.

Now place the bulb alongside a ther-

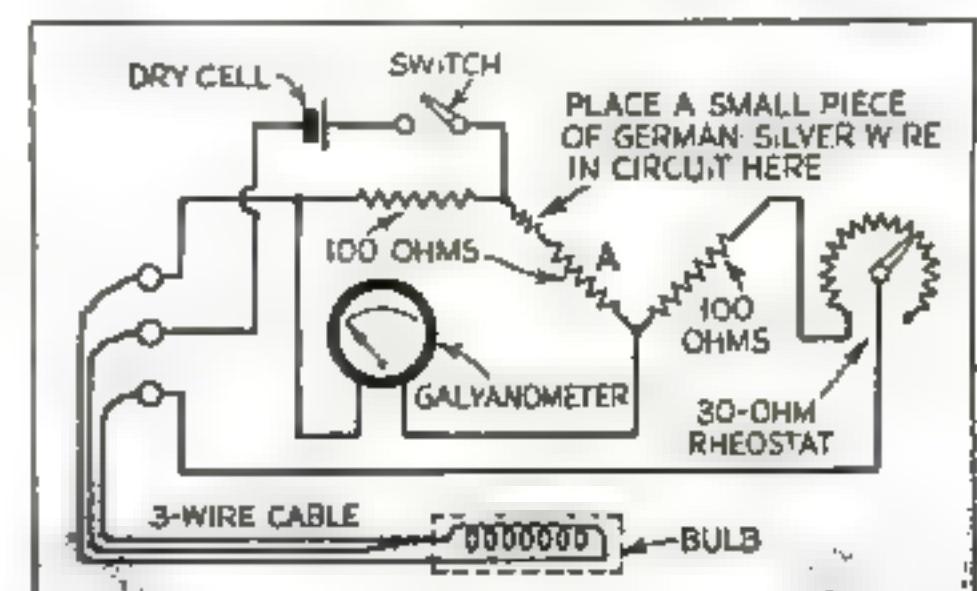


Fig. 2. The wiring is of the simplest kind

COMPLETE PLANS

Solid Scale Models of

By Donald W. Clark



TRANSPORT. This is a model of a new all-metal, twin-engined, low-wing, eight-place monoplane, known as the Lockheed 12. The drawings at right give details of all the sixteen parts

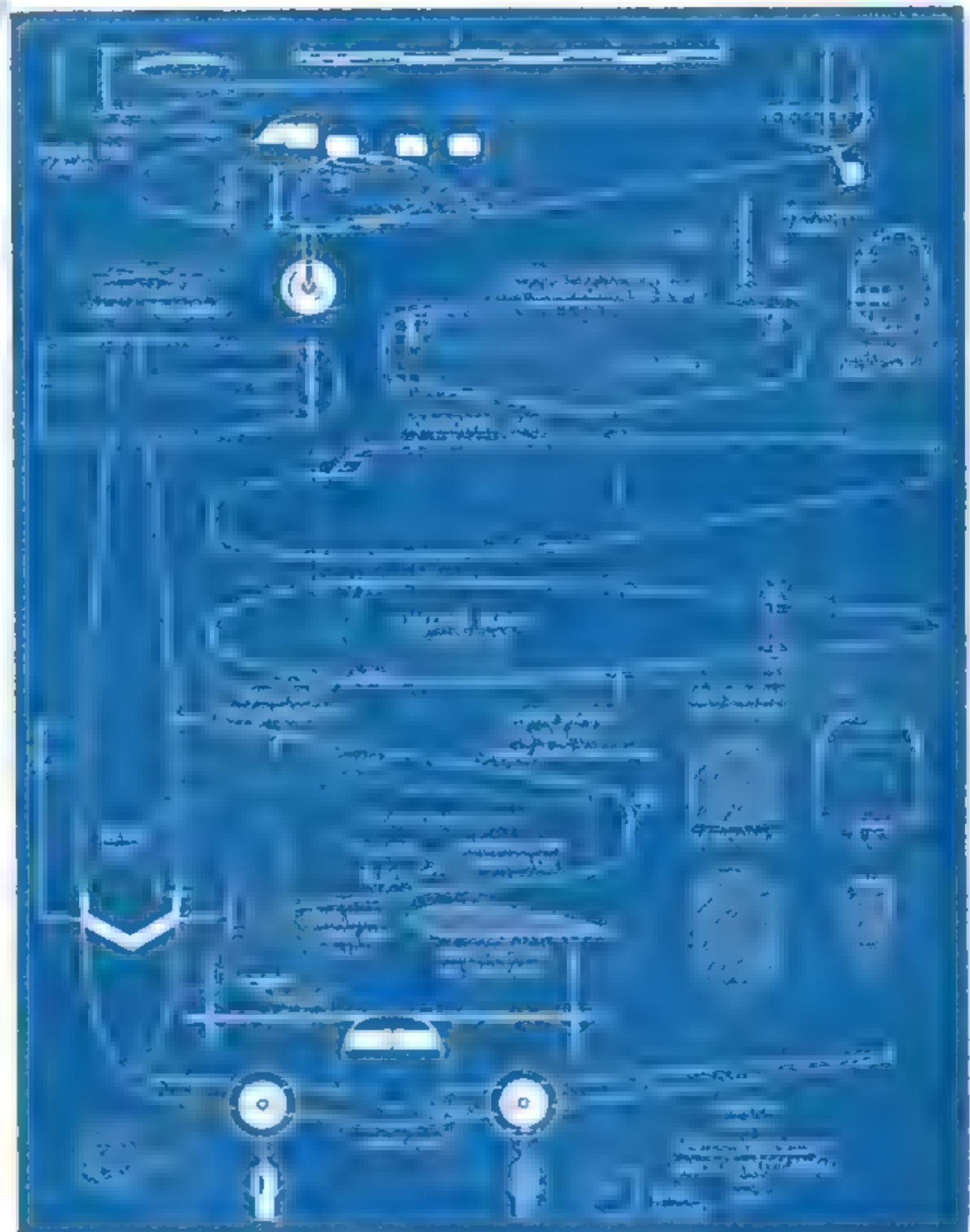
To celebrate the beginning of the eighth year of Donald W. Clark's series of scale model airplanes—the longest and best series of its kind ever published—we are giving three of his latest designs in one article. If you have never tried building model airplanes, begin with one of these. You will be surprised how easy they are to make. There are readers, by the way, who have built every model in the entire series, and that's a record hard to beat.

READERS who have been clamoring for more and more solid model airplanes should be satisfied this month because here are plans for simplified but accurately scaled models of three entirely different types. One is an eight-place transport, the second is a six-place seaplane, and the last is a two-place sport plane.

All the models are made to our customary scale of $\frac{3}{8}$ in. equals 1 ft. Each has been reduced to the smallest possible number of parts, and the individual pieces can be shaped with ease even by beginners. Soft, clear white pine is recommended for the wooden members, although balsa may be used, of course, by those who prefer the softer wood.

With models of this type, neat and careful finishing is of the utmost importance. You know how flawlessly finished the real planes are, so try to match their appearance. To do this, make sure that all surfaces are sandpapered to a silky perfection. Mark the location of windows, ailerons, and similar details accurately with a hard lead pencil so the lines are slightly indented; they will then show through the paint.

If a model is to be finished in aluminum all over, prime the wood with a thin coat of clear nitrate "dope" or model airplane "dope," if you happen to have some, and apply two coats of high-grade aluminum bronzing powder mixed with bronzing liquid. When, however, a model is to be painted some other color, use for a priming coat either flat white



wall paint or white enamel undercoat. Both cover very well and can be sanded lightly to a very flat finish. Over this undercoat apply a good grade of quick-drying enamel of the required color. One coat is usually enough, but a second coat may be applied if necessary, provided the first coat is rubbed down lightly with very fine sandpaper and dusted off.

India drawing ink gives a good dull effect for tires, cockpit openings, recesses in the cowling, and the like. Take pains to polish the metal propellers as brightly as possible, and be scrupulous in seeing that every detail is as neat as you can make it.

The new Lockheed 12 follows the same general lines of the Lockheed Electra (P.S.M.,

Nov. '34, p. 72), but is somewhat smaller. It is an all-metal, twin-engined, low-wing, eight-place monoplane designed for general use by the average airline and for carrying the local business of the larger lines. Among its features are a soundproofed, fully equipped cabin with 63 cu. ft. available for baggage and mail, retractable landing gear, wing flaps, and double rudder.

The specifications: Span, 49 ft. 6 in.; length, 36 ft. 4 in.; height, 9 ft. 9 in.; weight empty, 5,355 lb.; useful load, 2,570 lb.; power, two Wasp, Jr., SB rated 450 h.p. at 2,300 r.p.m. Performance: High speed, 231 m.p.h.; cruising speed, 208 m.p.h.; landing speed with flaps, 64 m.p.h.; service ceiling, 22,900 ft.; climb per minute, 1,400 ft.; cruising range, 665 miles.

In making a model of this plane, the engine "eggs" are the only parts of all sixteen pieces that require special care. The ones shown in the photographs near the end of this article were turned out by

FOR BUILDING Three Up-to-Date Planes

hand, without a lathe, and white pine was used. Saw the opening for the wing with accuracy to obtain a snug fit. Do the final fitting with a round file.

It will be noticed that some of the structural details of this model differ from the Electra. For instance, the wheel forks and tail group are designed with fewer parts. If desired, the wheels can be made retractable as shown by dotted lines on the drawing.

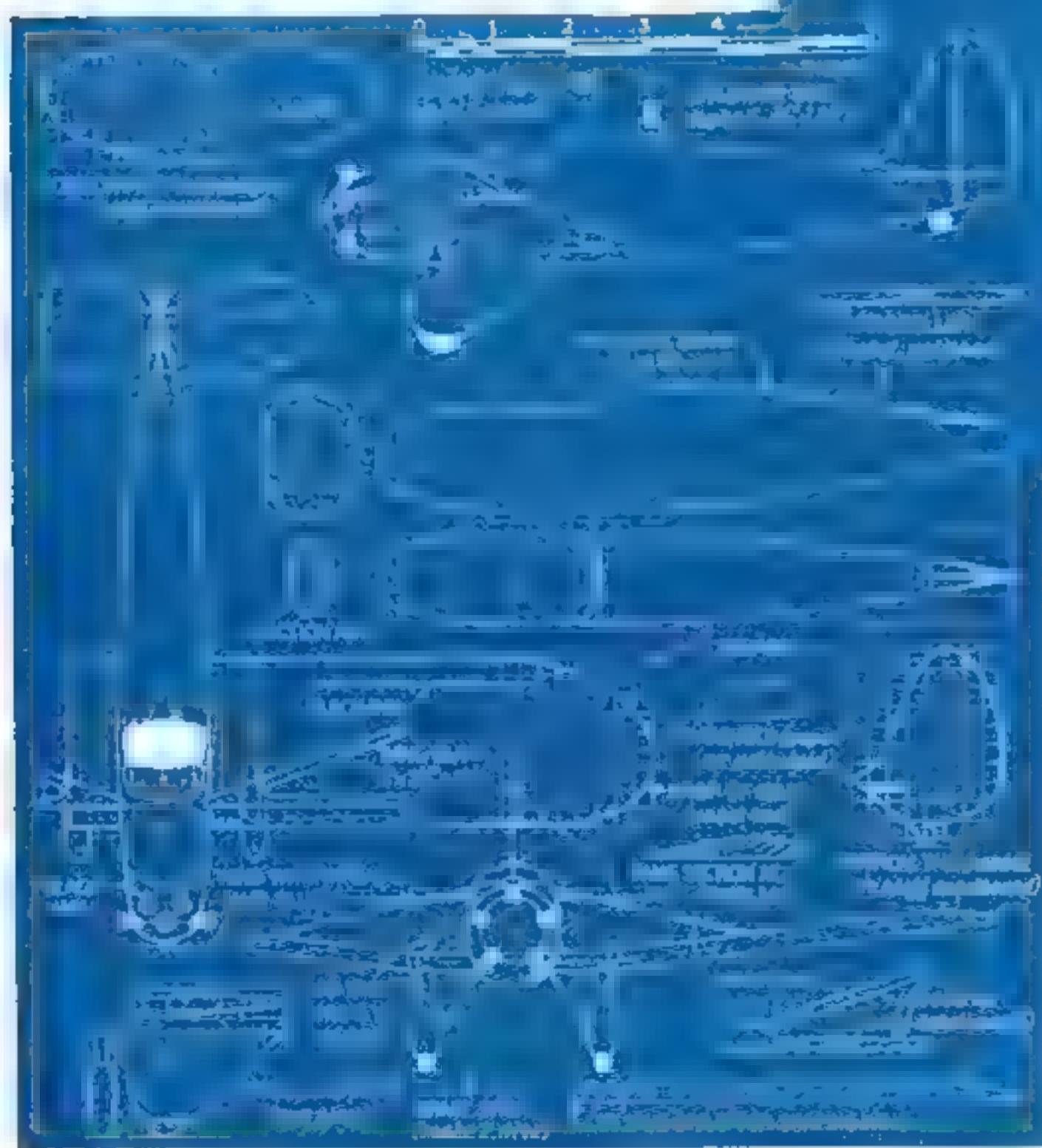
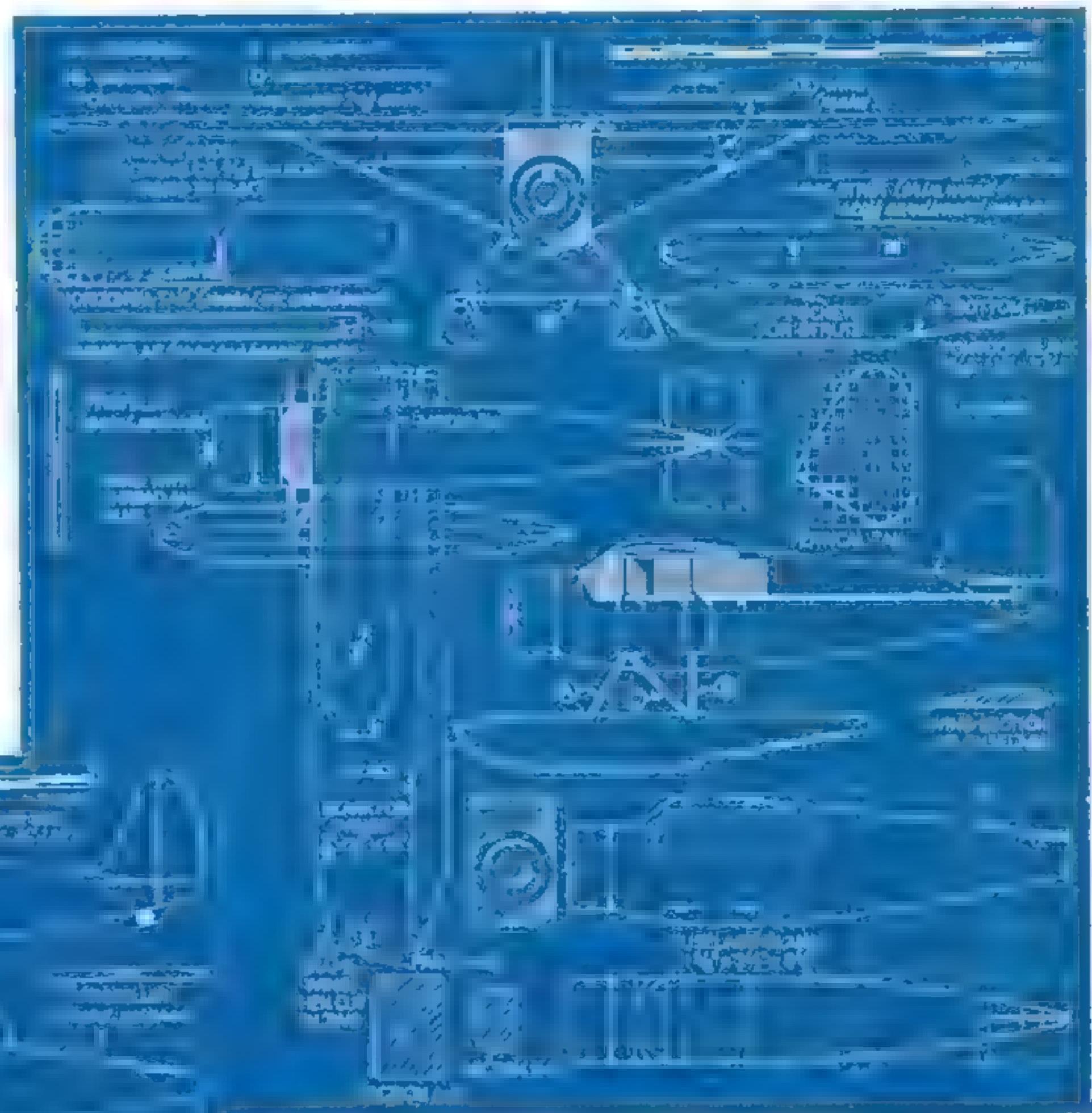
Paint the entire plane aluminum or light gray and add the windows, tires, cowl openings and trim in black.

The second project is a seaplane, the Bellanca senior Pacemaker, a six-place ship popular at the seashore, along rivers, and on small lakes. The span is 50 ft. 6 in., length 27 ft. 11 in.; height, 8 ft. 6 in.; weight empty, 3,250 lb.; useful load, 2,350 lb.; fuel capacity, 200 gal.; engine, Wright Whirlwind R-975-E3, rated 420 h.p. at 2,150 r.p.m., high speed, 100 m.p.h.; cruising speed, 145 m.p.h.; landing speed, 64 m.p.h.; service ceiling, 12,000 ft.; climb per minute, 700 ft.; cruising range, 860-1,100 miles.

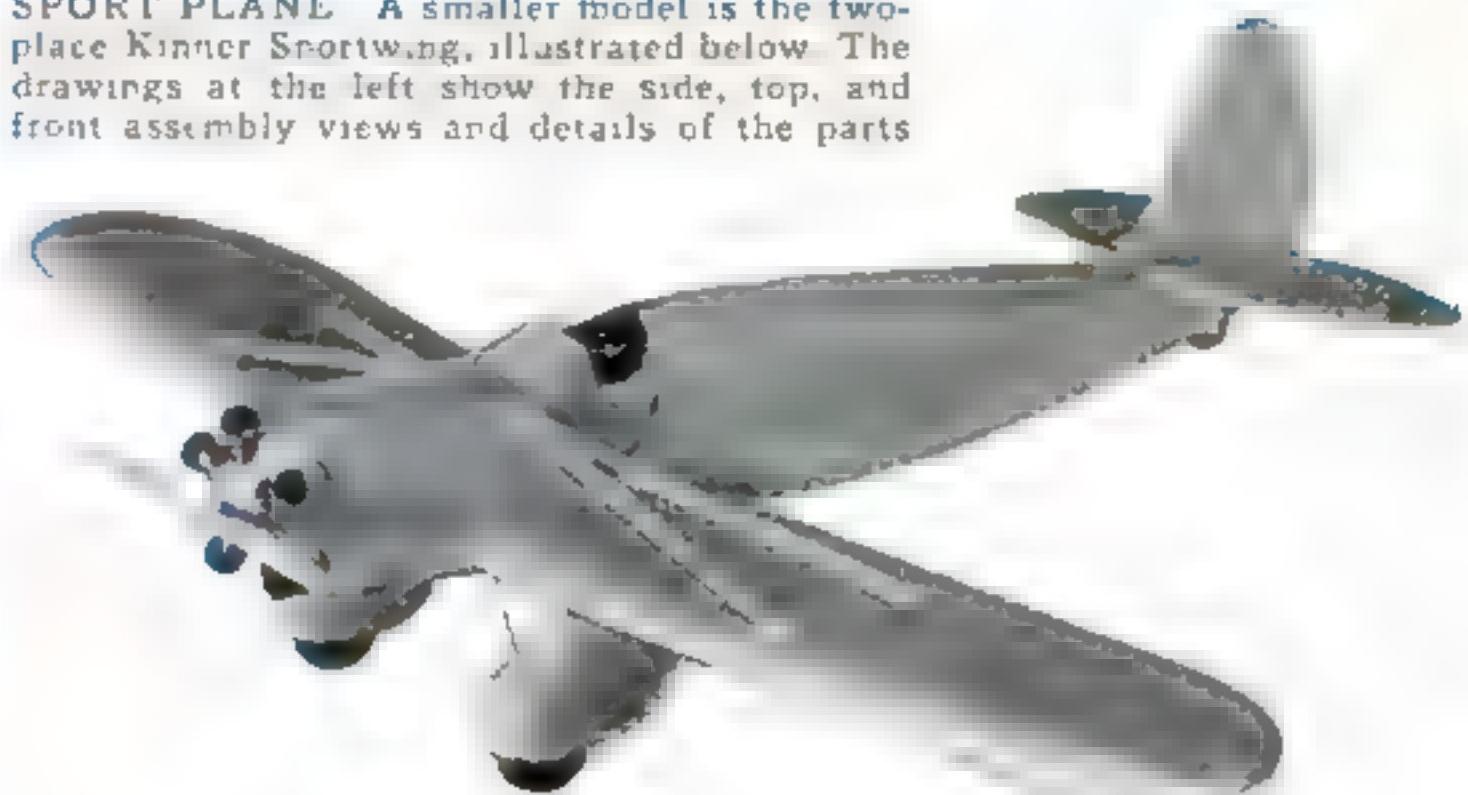
Twenty-two simple parts are required for the model. If white pine is used, the task of shaping the pontoons and other parts will be quite easy. The pontoon struts should be glued into pockets in the fuselage and on the pontoons, as shown. First, glue the cross members *D* to the pontoons, then the upright pieces *A* and *B*. Set the fuselage on these and hold or prop it up until the glue sets. The brace pieces *C* should be attached last. The diagonal struts are drawn extra long to allow for cutting and fitting. This assembling should, of (*Continued on page 75*)



SEAPLANE. Model of the six-place Bellanca senior Pacemaker as built by Mr. Clark, and, below, the drawings. Twenty-two parts are required



SPORT PLANE A smaller model is the two-place Kinner Sportwing, illustrated below. The drawings at the left show the side, top, and front assembly views and details of the parts

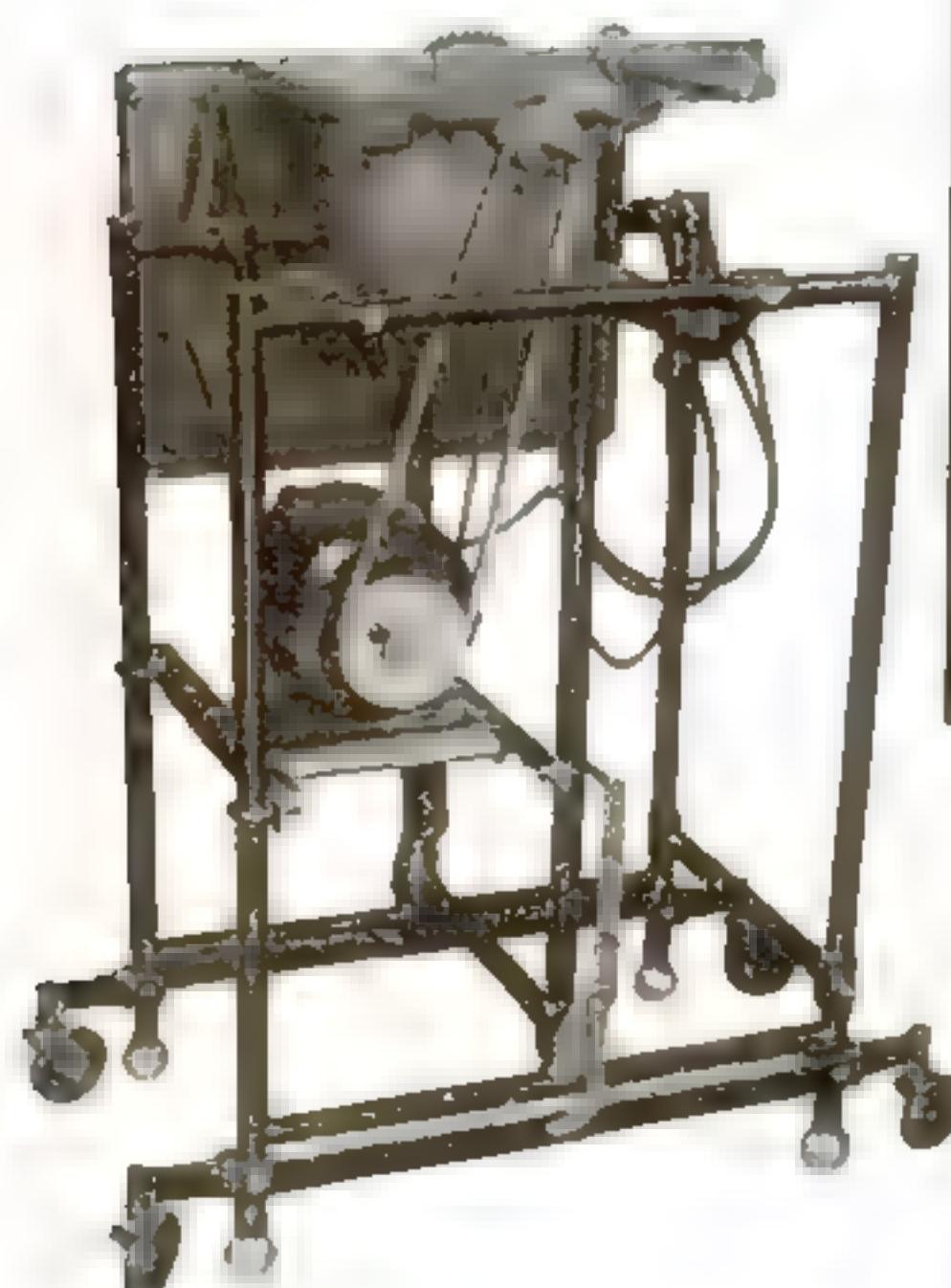


Home Workshop Projects

SHOW READERS' SKILL

BUILDS LARGE MODEL RACING YACHT

One of the largest model racing yachts—*Olympic*, international class A, built by Walter K. Moss, Milwaukee, Wisc. Over-all length, 84 in.; height, 122 in.; keel weight, 36 lb.; sail area, 1,654 sq. in. On open-water sailing, a motor boat is necessary to catch the model. Much of the hull is so thin a strong light can be seen through it



MOVABLE STAND FOR BENCH SAW

D. R. Doremus, of East Rutherford, N. J., was looking for a good way to mount a small circular saw when he noticed an old adding-machine stand knocking around an office where it was no longer wanted. He obtained it and fastened the saw and motor to it as shown above. The whole can be moved easily, yet the legs can be lowered firmly against the floor for use



DORIES MADE BY BOYS

Right: This dory was built by John Newacheck, of El Dorado, Kans., when he was 16. That shown above was constructed by Bartho Eicker, of Rosedale, N. Y., with the help of his father. Both are from our plans (P.S.M., Apr. '35, p. 62)



CAMOUFLAGED DESTROYER

Model of the U. S. destroyer *Preston* constructed by Joe Sanford, of Bath, Me., from *Popular Science Monthly* blueprints. Both sides of the model are camouflaged differently according to dazzle-painting schemes actually used for ships in the World War



MODEL OF SPY HOUSE, HURLEY, N. Y. Mark Pennington, of Kingston, N. Y., built this model of the house where Daniel Taylor, a British spy, was held in Revolutionary days. It is complete to the hardware and a tiny copper dipper by the rear door. The walls are of plaster of Paris with glass windows, and the rear addition is of wood. The figure of the boy rolling a hoop is a painted wood carving. The rose bush is of bridal veil with paper leaves. Scale: $\frac{1}{4}$ in. to 1 ft.



DESK UNIT ADAPTS TABLE FOR WRITING PURPOSES

Designed and made by C. P. Blake, of Oregon City, Ore., this desk unit includes a drawer and book racks at each end, and the top is grooved for pens and pencils. The dish-shaped blocks in each rear corner were turned on the lathe and glued in place to hold pins and paper clips. The unit may be placed on any table





By
KENNETH MURRAY

METAL stretches. On the kind of metal, its thickness and malleability, depends the ease with which it can be stretched. Sheet metal of No. 36 gauge, generally known as metal foil, can be stretched, modeled, and formed with such simple tools as nut picks and orange manicure sticks.

Examples of this new handicraft are illustrated, but they are intended to show only how the work is done, and your imagination will quickly supply ideas for dozens of other designs, novelties, and useful gifts. A particularly good use for the foil is in making relief or embossed ornaments for other projects such as wood chests and metal boxes, book ends, the bases of table lamps and legs of furniture, and as a facing for individually designed wood picture frames, wall plaques, mirrors, and the like.

The ornaments can be applied to any surface, curved or flat, and when reinforced as described later, they cannot be distinguished from ornaments cast in copper, brass, or silver. They can be chemically colored or electrically plated as easily as the cast metal and by the same methods.

Of course, the foil is not the kind used as a wrapping for chocolate bars. It is a very light, inexpensive sheet metal made for the purpose and sold by a number of craftwork supply dealers. The copper foil is recommended as easiest for the beginner to work with, but the material also comes in brass and an imitation silver alloy that takes a high polish. The sheets are about 12 in. wide and up to 60 in. long. There is one substitute, obtainable anywhere at garages, that you can use for trial work. It is thin shim brass. This is quite springy so it will have to be softened or annealed by bringing it to an even red heat over the gas stove. Heat it for only a moment, to avoid warping, and allow it to cool slowly.

The tools used for leather tooling are equally suitable for foil, but lacking them it is suggested that you purchase a set of six nut picks like those shown; the cost is usually 15 cents at hardware stores. Smooth up the point of one, so that it cannot cut or scratch the foil, and use it

Metal Tooling

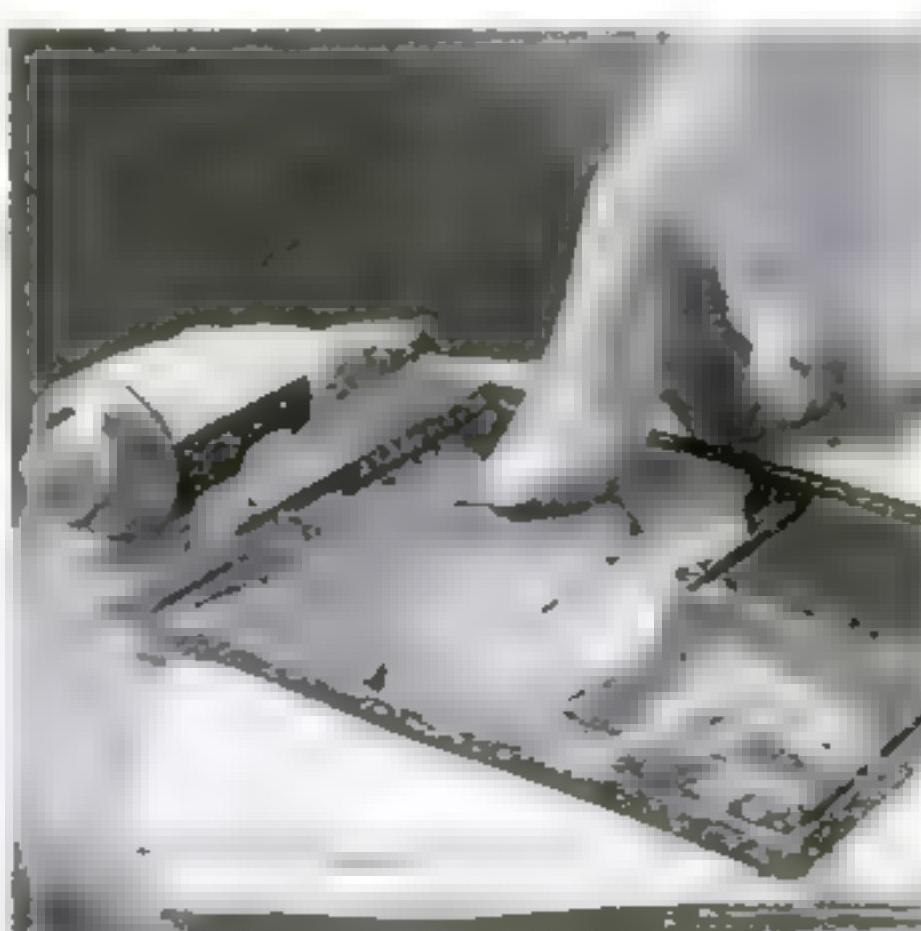
... A new way to make novelties, name plates, calendars, greeting cards, and innumerable ornaments



Using a tool made from a nut pick to mark the lines on the metal foil—the first step in tooling the calendar shown at left above



After the lines have been pressed in deeply enough, the metal is turned over and laid on a smooth, hard surface. Then the background is smoothed down with an orange stick



When the modeling has been completed, the back of the foil is reinforced with plastic composition wood if it is to be attached to wood, or with solder if it is to go on metal



A monogram to be attached on the door of an auto and, at left, a greeting card made from the foil

for general work in making lines. Later, you can grind the ends of the others to various shapes as required. Inasmuch as these slender tools will tire the fingers after working for a time, it is a good plan to make a finger grip about 1 in. from the working point by wrapping the shank with adhesive tape. Composition wood paste is even more suitable for the purpose.

Various methods of transferring the design to the foil have been suggested, but the author prefers the following procedure: Clip the design to be copied to a piece of thin tracing paper and carefully mark the lines on the latter with a pencil. Cut a piece of the foil to size with scissors, then give one side a thin coat of petrolatum (petroleum jelly). If you use too much, the design will slip. Lay the tracing on the foil, either right side up or reversed, as required, and press it down. Then rub a little petrolatum on the tracing paper; this will not only act as a lubricant for the tools, but will also make the penciled lines stand out very clearly.

Lay the foil on a folded newspaper and go over the lines with the tool, using enough pressure to make the lines show in slight relief on the back. Peel off the tracing paper, wipe off most of the petrolatum, and with the foil again on the newspaper, go over the lines so that they will show in greater relief on the other side.

It is better to go over the lines several times rather than try to gain full relief the first time. You will find that the thin metal stretches quite easily; in fact, after you have had a little experience, you can model it almost as you please. Also, with more experience, you will be able to hold the tool in the fist to exert more pressure. Do not try this at first, however, for you would probably cut through the metal. In following curves (*Continued on page 87*)

Kinks for Car Owners



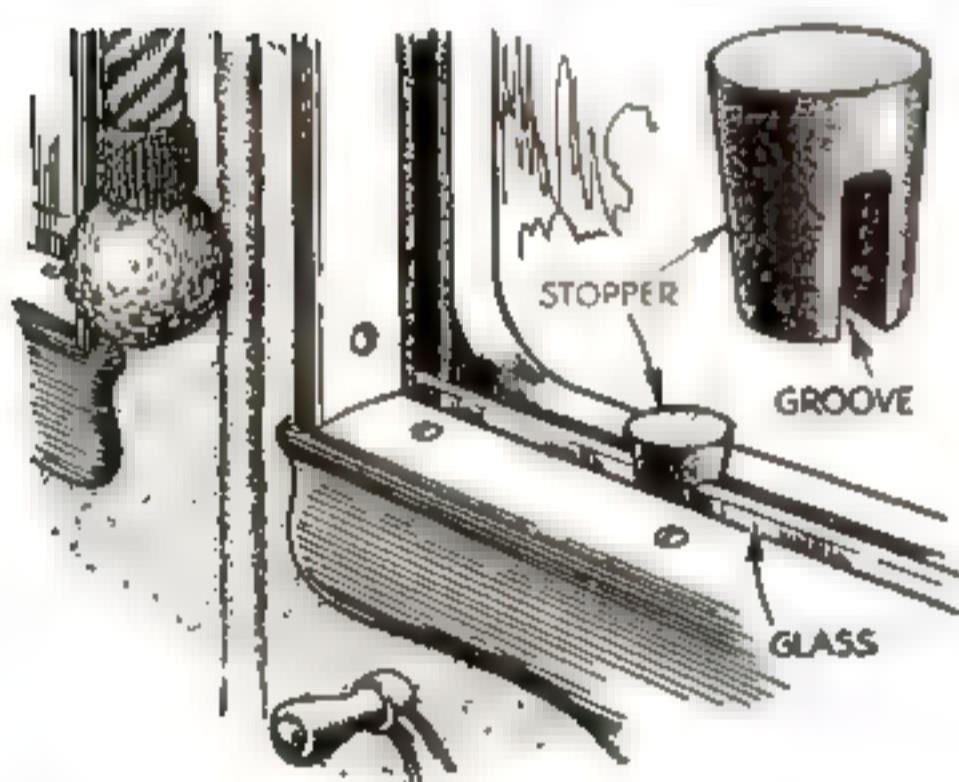
Wrapped around the intake manifold or carburetor, a bag of hot sand speeds up early-morning starts in icy weather

OUR READERS PASS ALONG HINTS THAT HAVE HELPED THEM TO KEEP THEIR AUTOMOBILES IN CONDITION

Hot Sand Bag Warms Cold Motor

ALTHOUGH starting cold motors generally can be made easier on icy mornings by pouring hot water over the intake manifold, the job of applying the water is cold and messy. A more convenient method makes use of a long, tubelike bag containing salt or sand. Placed in an oven, or on a radiator, and warmed, it will retain its heat for some time and can be wrapped around the intake manifold or carburetor easily and quickly. The bag, made from heavy canvas and partially filled with coarse ice-cream salt or sand, should be about three inches wide and three feet long. Salt seems to absorb heat faster and to hold it longer than sand. In warming the bag, care must be taken to prevent scorching the canvas cover.—A. H. W.

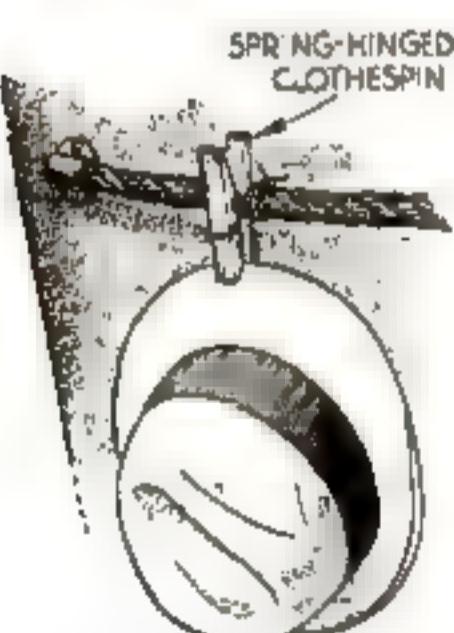
Bottle Stopper Silences Window Rattles



Grooved to take the edge of the glass, the stopper is wedged into the window opening

Convenient Hat Holder Made from Clothespin

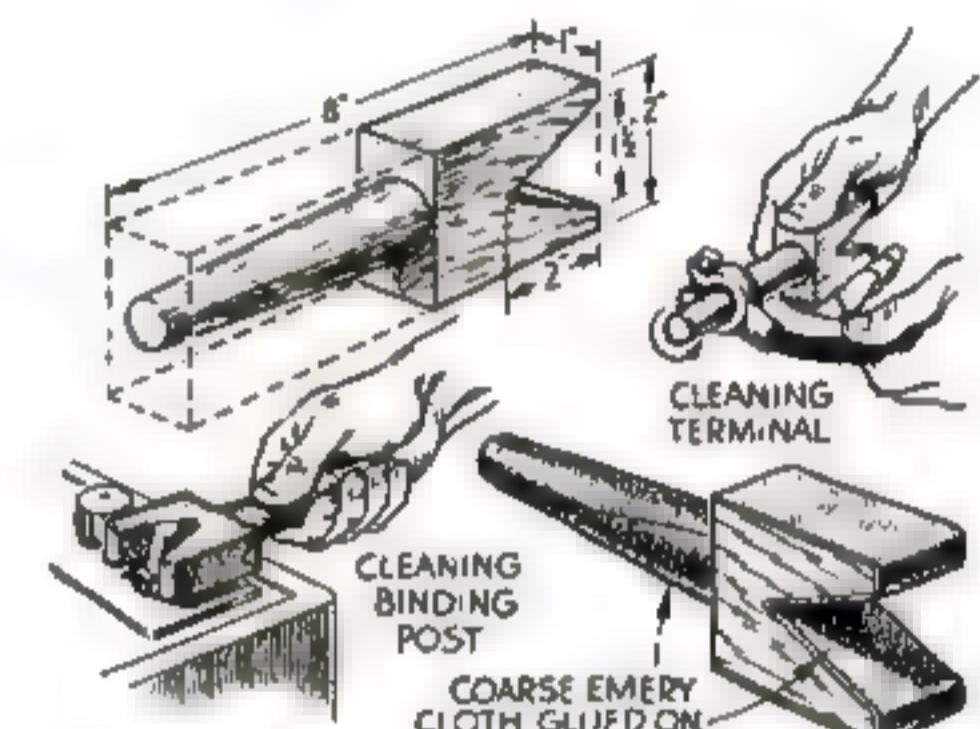
ON LONG drives, it is often difficult to know what to do with your hat when you do not feel like wearing it. I solved the problem by tying an ordinary spring clothespin to the robe rope at the back of the front seat. The clothespin holds the hat securely and protects it from being crushed or smudged. When not used to hold my hat, the clothespin provides an excellent hanger for newspapers, road maps, or shopping lists. In the near future, I plan to install a second clip, near the other end of the robe rope. Then, in rainy weather, I'll have an improvised rack for the umbrella that now rattles around on the floor of the car.—A. McC.



SEDAN and coupé windows that tend to rattle when they are down generally can be silenced with a grooved wedge made from an ordinary bottle cork or rubber stopper, as shown in the illustration at the left. Slotted to take the thickness of the glass, the cork is simply pushed down over the window and wedged between the edges of the opening. The cork will also help prevent breaking of the glass.—A. H.

Bath Renews Old Gaskets

OLD VALVE-HEAD gaskets that have dried out often can be rejuvenated with a water bath. Simply place the shrunk gasket in a pail of warm water. After a short soaking, you will find that the cork has expanded sufficiently to make the unit fit perfectly.—E. J. N.

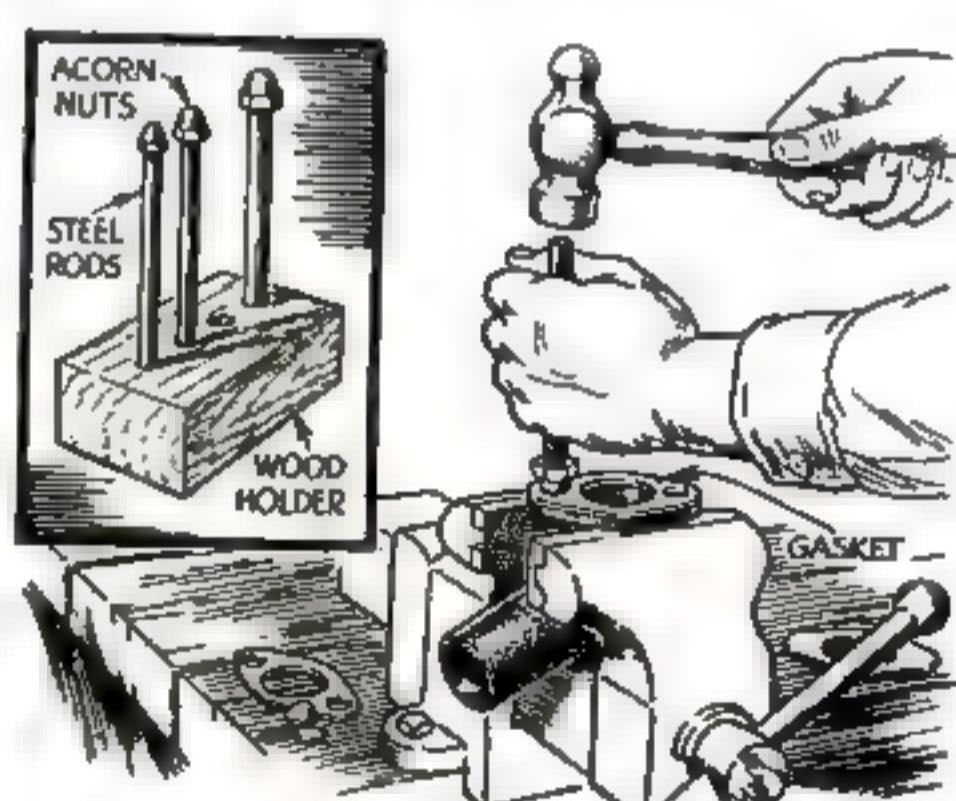


Homemade Battery Tool Cleans Terminal Posts

A HANDY tool for cleaning storage-battery terminals and cable clamps can be made from a scrap of wood and a few pieces of coarse emery cloth. Cut with a saw, whittled or turned to shape, and covered with the emery as shown above, the tool provides a V-shaped cleaner for the battery posts and a tapered emery stick for the inside surfaces of the clamps. Furniture glue or a cement of the transparent type can be used to hold the emery cloth in place.—W. A.

Odds and Ends form Handy Punch Set

FROM a selection of ordinary steel acorn nuts, the amateur mechanic can provide himself with an efficient set of punches for cutting stud holes in cork or composition gaskets. They need only be screwed on threaded steel rods, or on long bolts whose heads have been cut off. To punch the holes, the gasket is placed over the part, which serves as a pattern, and the punch held over the hole and hit with a hammer. Since acorn nuts are available in a wide variety of sizes, from three sixteenths of an inch to more than one inch in diameter, a punch for gasket holes of almost any size can be made. As shown in the illustration at the right, a wood block provided with holes forms a handy holder for the punch set.—H. W.



A set of acorn-nut punches, and how they are used to cut the stud holes in motor gaskets



Another Christmas special—4 boxes of Camels in "flat fifties"—wrapped in gay holiday dress. (right, above)

Camels

There's no more acceptable gift in Santa's whole bag than a carton of Camel Cigarettes. Here's the happy solution to your gift problems. Camels are sure to be appreciated. And enjoyed! With mild, fine-tasting Camels, you keep in tune with the cheery spirit of Christmas. Enjoy Camels at mealtime—between courses and after eating—for their aid to digestion. Get an invigorating "lift" with a Camel. Camels set you right! They're made from finer, MORE EXPENSIVE TOBACCOS—Turkish and Domestic—than any other popular brand.

Prince Albert

It's easy to please all the pipe-smokers on your list. Just give them the same mellow, fragrant tobacco they choose for themselves—Prince Albert—the National Joy Smoke. "P. A." is the largest-selling smoking tobacco in the world—as mild and tasty a tobacco as ever delighted a man. And Prince Albert does not "bite" the tongue. Have bright red-and-green Christmas packages of Prince Albert waiting there early Christmas morning...to wish your friends and relatives the merriest Christmas ever.



One full pound of mild, mellow Prince Albert—the "bite-less" tobacco—packed in the cheerful red tin and placed in an attractive Christmas gift package. (far left)

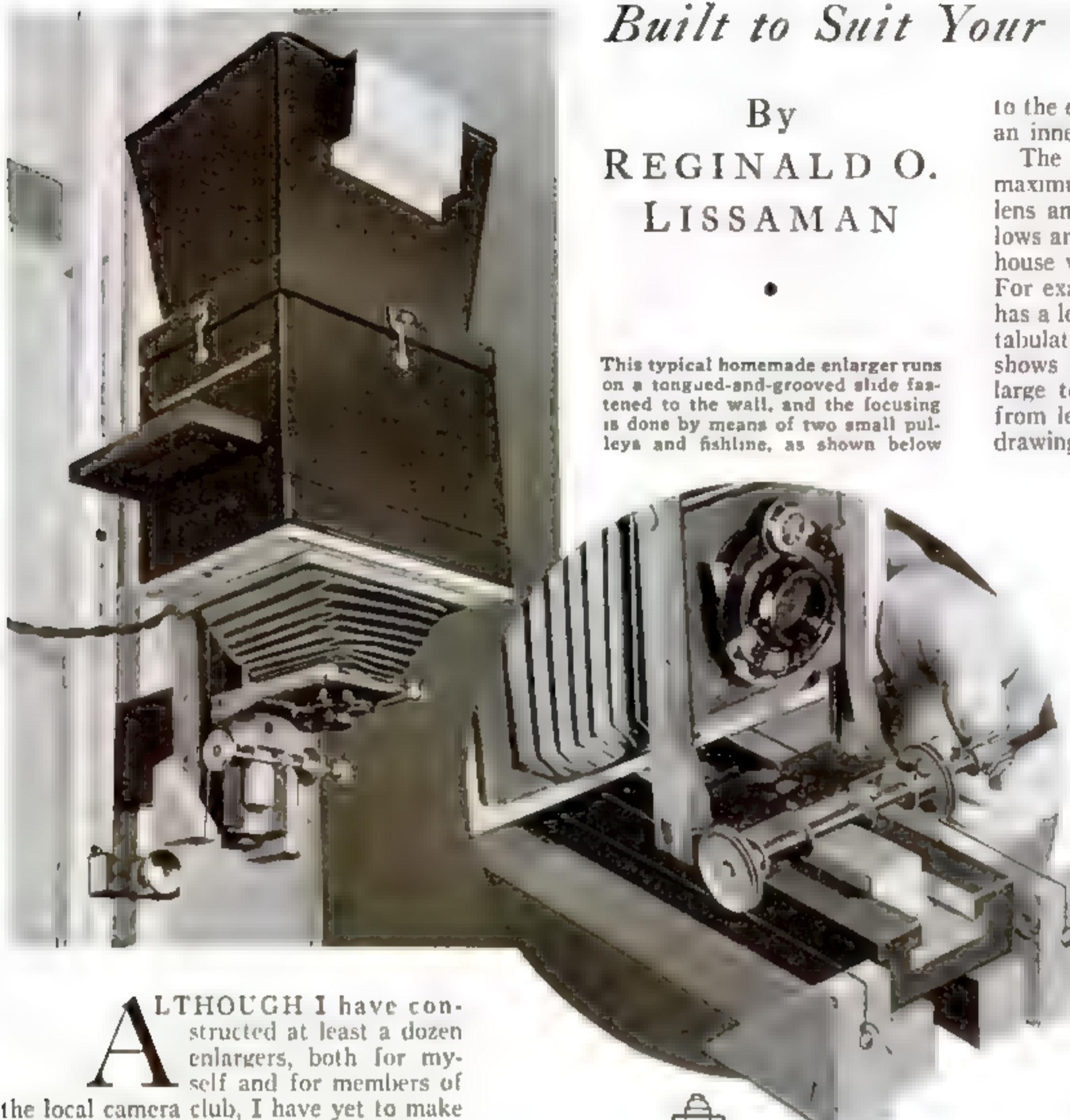
Here's a full pound of Prince Albert, packed in a real glass humidor that keeps the tobacco in perfect condition and becomes a welcome possession. Gift wrap. (near left)

LOW-COST Enlarging Camera

Built to Suit Your Own Needs

By
REGINALD O.
LISSAMAN

This typical homemade enlarger runs on a tongued-and-grooved slide fastened to the wall, and the focusing is done by means of two small pulleys and fishline, as shown below.



ALTHOUGH I have constructed at least a dozen enlargers, both for myself and for members of the local camera club, I have yet to make two exactly alike. This is due mainly to the fact that a different lens, bellows, or camera was available in each case. Instructions for making one particular enlarger for a certain specified lens equipment would not therefore be of much help, so I shall tell how any reader, even if he is not familiar with enlarging cameras, can construct one to suit his own needs with very little cash outlay. So much added enjoyment is obtained when one can view enlargements from his own negatives, that the labor involved is well repaid.

The efficiency of a homemade enlarger depends upon the care given its construction and upon the quality of the lens used. Prints from the one illustrated have been hung in several photographic salons, and there is no reason why you should not build one every bit as good as a factory-made model of corresponding type.

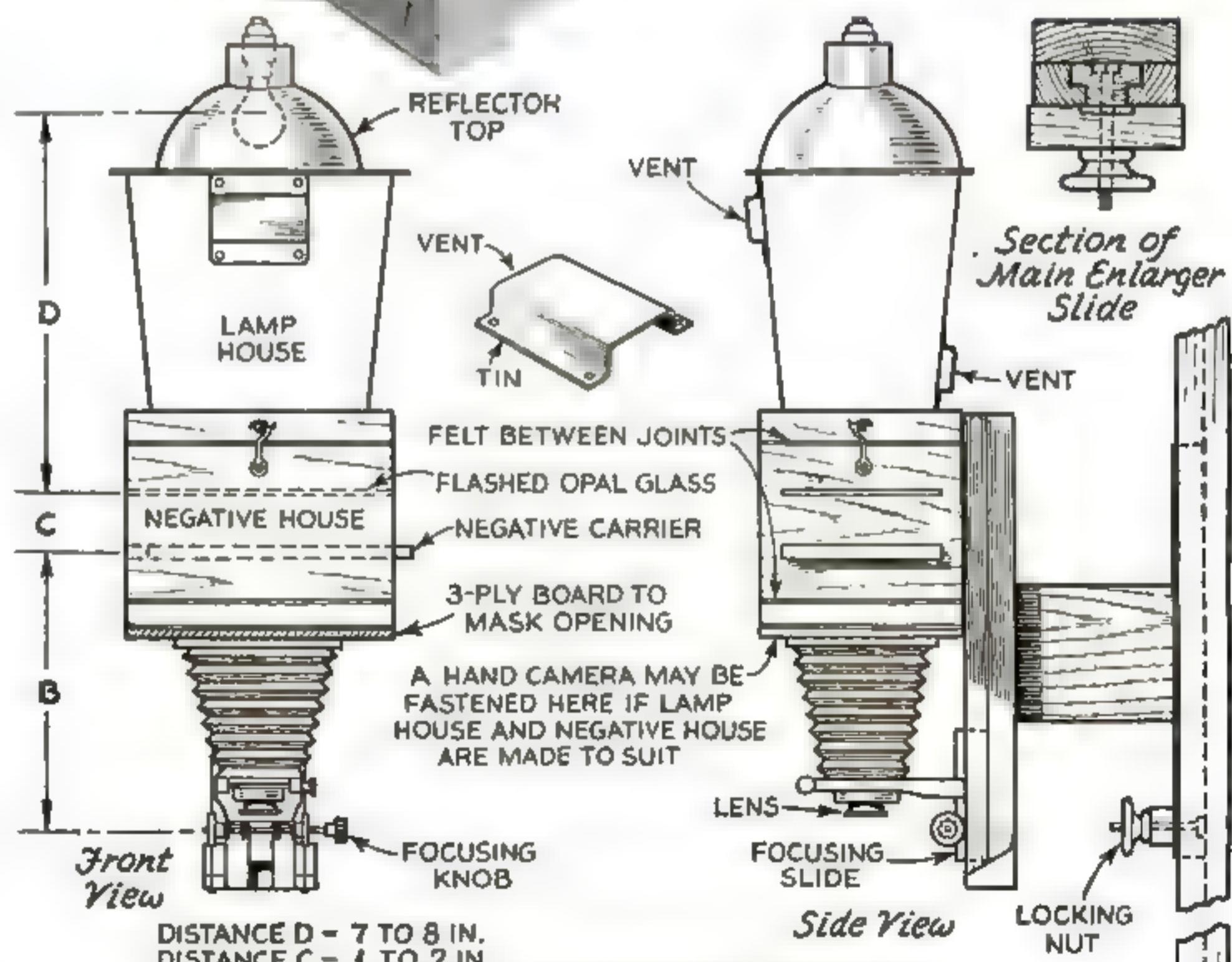
Providing the camera bellows are adjustable, your regular camera may be used as part of the enlarger. While this will reduce the cost considerably, it is not an unmixed blessing. When you want the camera for one purpose, it is tied up on another job, so that if you can obtain a second-hand camera with a fair lens, by all means do so. Should you decide to use your regular camera, some means will have to be devised for clamping it temporarily

to the enlarger. Strong rubber bands from an inner tube will serve.

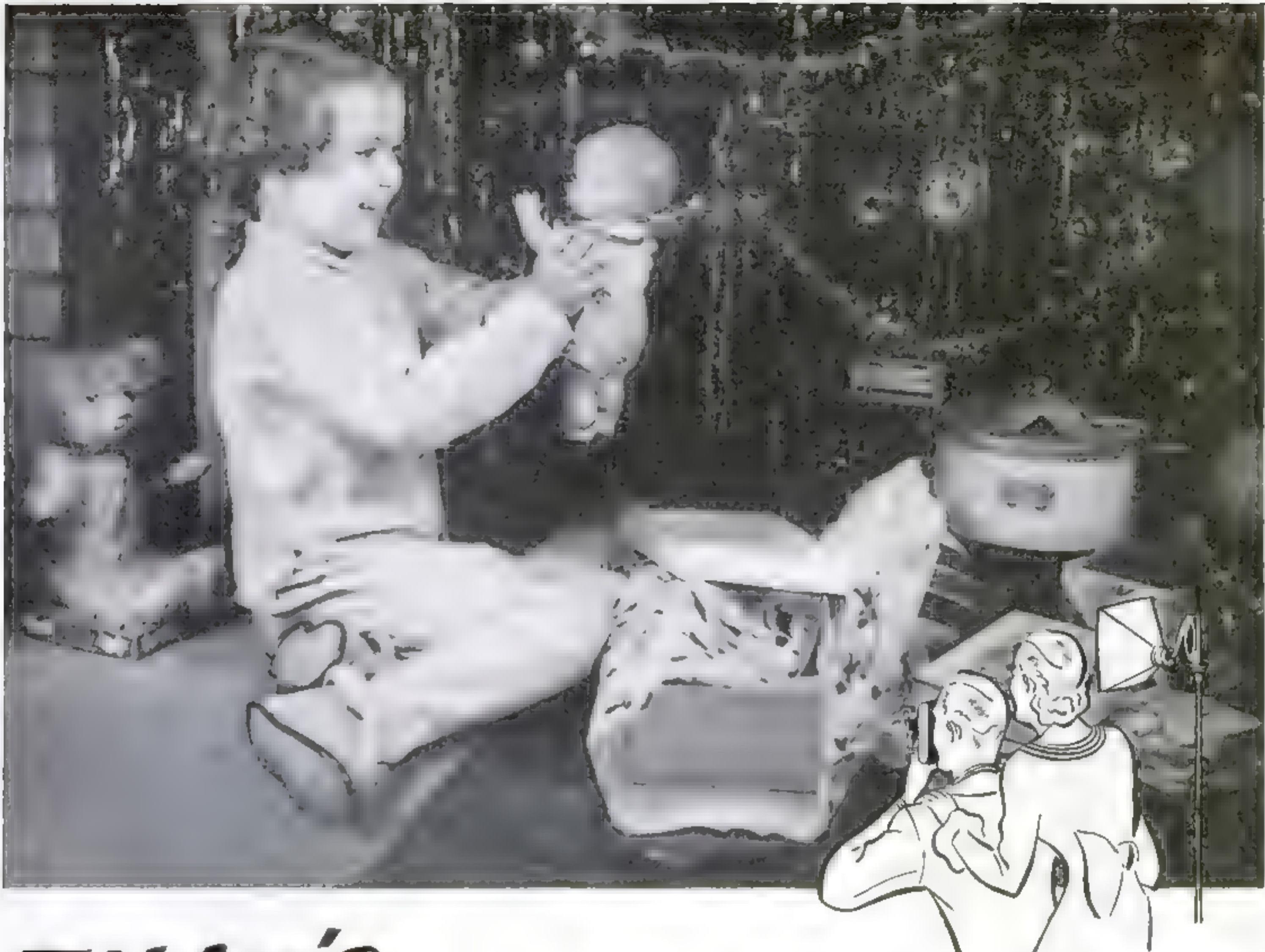
The first thing to be determined is the maximum and minimum distances between lens and negative. If the camera or bellows are of limited extension, the negative house will have to compensate this fault. For example, suppose the camera available has a lens with a focal length of 4 in. The tabulation near the end of this article shows that when focused sharply to enlarge to double dimensions, the distance from lens to negative (distance *B*, in the drawing) will be 6 in. At the position for a seven-times enlargement, distance *B* will be $4\frac{4}{7}$ in. Now a camera with this lens equipment usually has a bellows permitting an extension of only about $4\frac{1}{2}$ or 5 in. at the most, so the negative carrier must be moved up in the negative house the difference between the extension of the bellows and the extension necessary for the two-times enlargement (i.e., $1\frac{1}{2}$ or 1 in. farther from the camera back).

Assuming that you have the lens bellows or camera to be used, it would be well at this stage to make a rough sketch and mark down all measurements as they are determined. This will give you something definite to work from.

(Continued on page 84)



The details of construction may be varied to suit the available materials and type of reflector used. Groove walls of the negative house for the negative carrier and opal glass before assembly



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TO BE SURE OF DEPENDABLE LIGHT FOR PICTURE-TAKING, LOOK FOR THE MARK  WHEN YOU BUY.

A LOW-COST ENLARGER

(Continued from page 82)

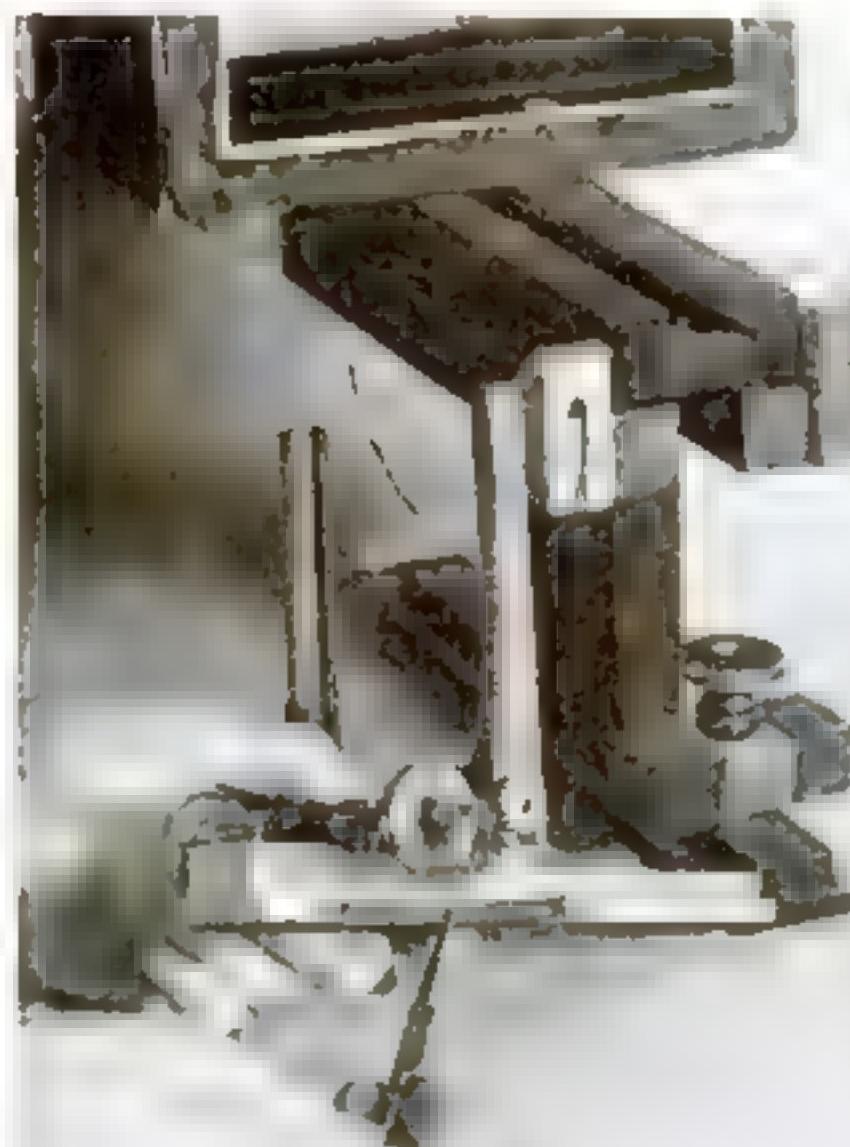
The next thing to have bearing on the size of the negative house will be the flashed opal glass (obtainable from any camera supply company). This should be located from 1 to 2 in. from the negative. If closer than 1 in., there is a danger that some speck of dust may be in focus when the lens is stopped down. In addition, sufficient material must be allowed on the negative housing to make a good connection with the lamp house. The cross area of the negative housing should be larger than the bellows or camera to be used, because this seems to give more even lighting of the negative. The slot for the negative carrier is open-wiched between two pieces of flawless glass.

The negative carrier is made like a picture frame, or a printing frame with rabbet deep enough to take the negative, with mask, sandwiched between two pieces of flawless glass.

The lamp house is a part that requires a little experimenting to assure even projection of light. If the enlarger projects a beam of light that is bright in its center and weakening towards its margins, the print will show the same characteristics. This must be avoided. The lamp house should be of the same cross area as the negative house, and it may have either a flat top or a reflector top. For the latter type some workers use an old auto headlight reflector, others an aluminum mixing bowl. The reflector used in the enlarger illustrated was spun on the lathe, being formed directly in the toppiece of the lamp house before assembly.

This choice of materials should not, however, lead one to assume that their use is unimportant. On the contrary, each will defeat its own purpose unless it is particularly adapted to the enlarger it is to be used in.

First, cut a hole in the center of the reflector large enough to admit the small end of the light globe—either a photoflood or a regular type lamp. With the bulb projecting through the reflector, screw it into the socket of an extension cord (so you are free to move it about). The light is turned on, and the reflector is held over a light-colored piece of card or paper at the distance the reflector will be from the opal diffusing glass in the completed enlarger. The card should be of the same dimensions as the opal glass. Now move the globe in and out in the reflector till the light appears to cover the card completely and evenly. This gives (Continued on page 96)



Lens front and slide assembly. A flat spring is let into the "blade" of the slide to prevent slipping and keep the slide pushed to one side of the track so that the lens front will always remain parallel to the negative

Kodak

FOR THOSE WHO LIKE THEM SMALL

Miniature Kodaks



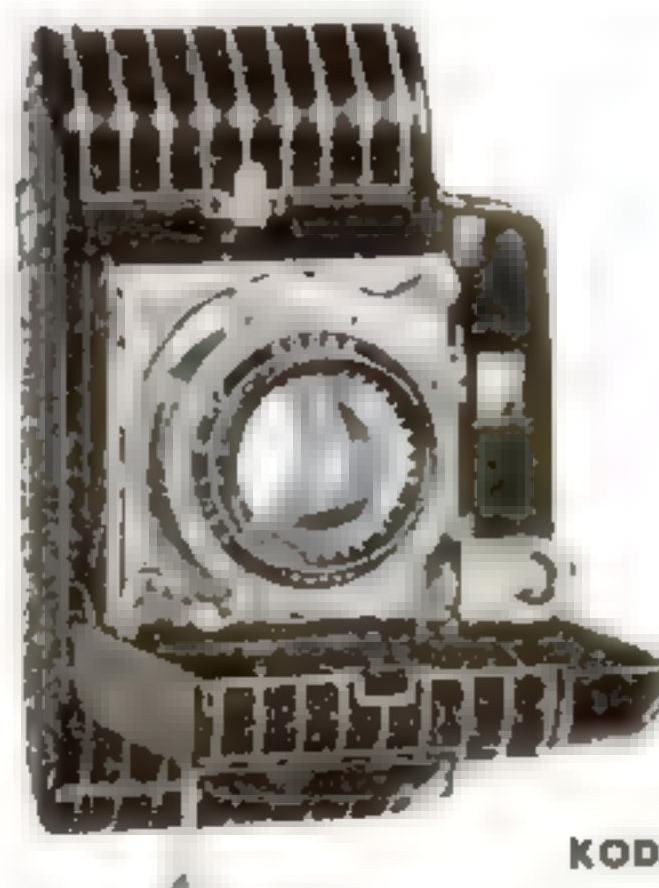
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Christmas Guide

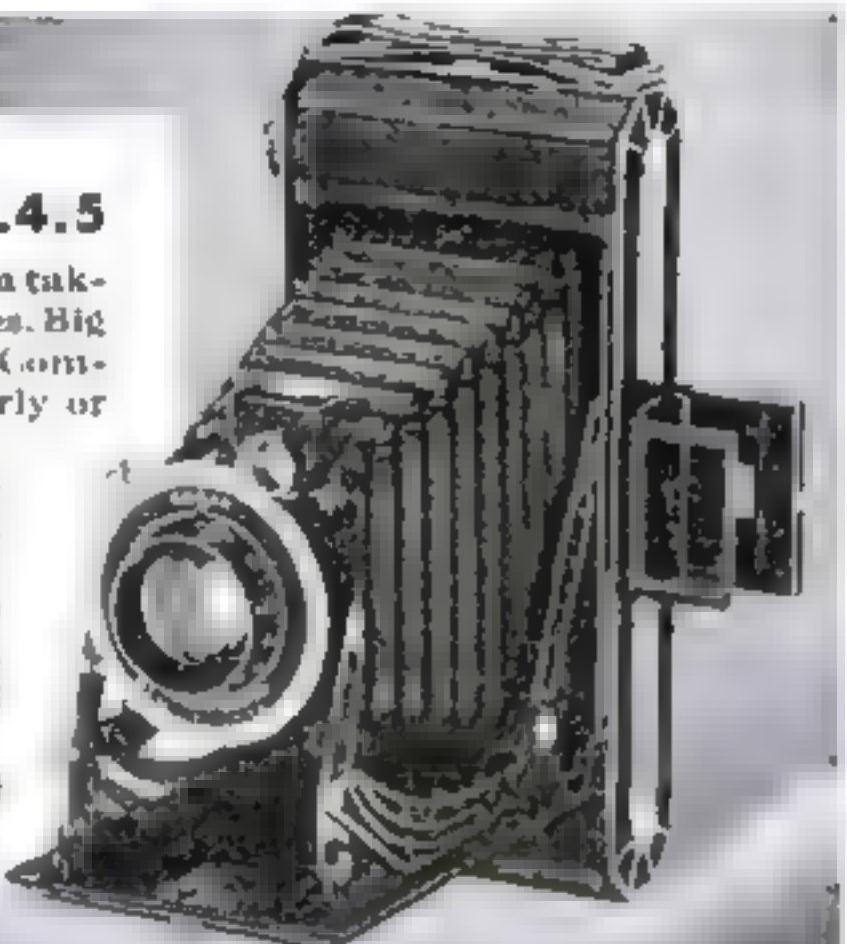
FOR THOSE WHO LIKE THEM LARGER

Precision Kodaks

KODAK SIX-16 f.4.5

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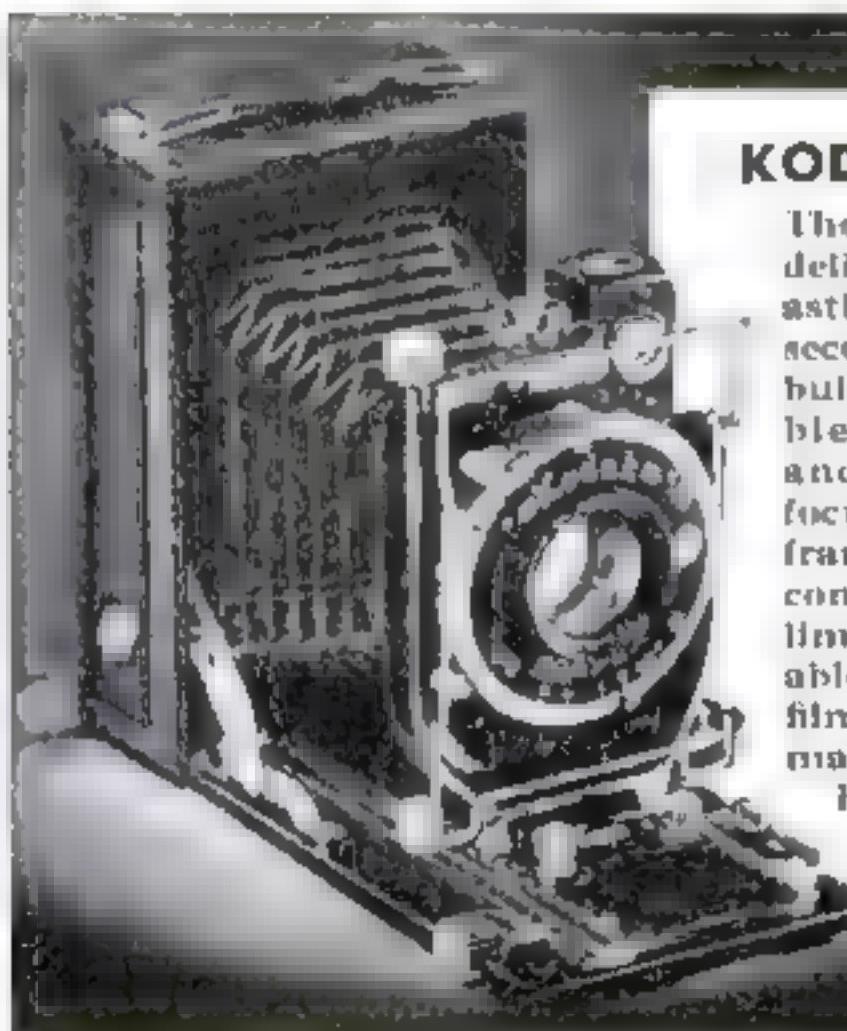
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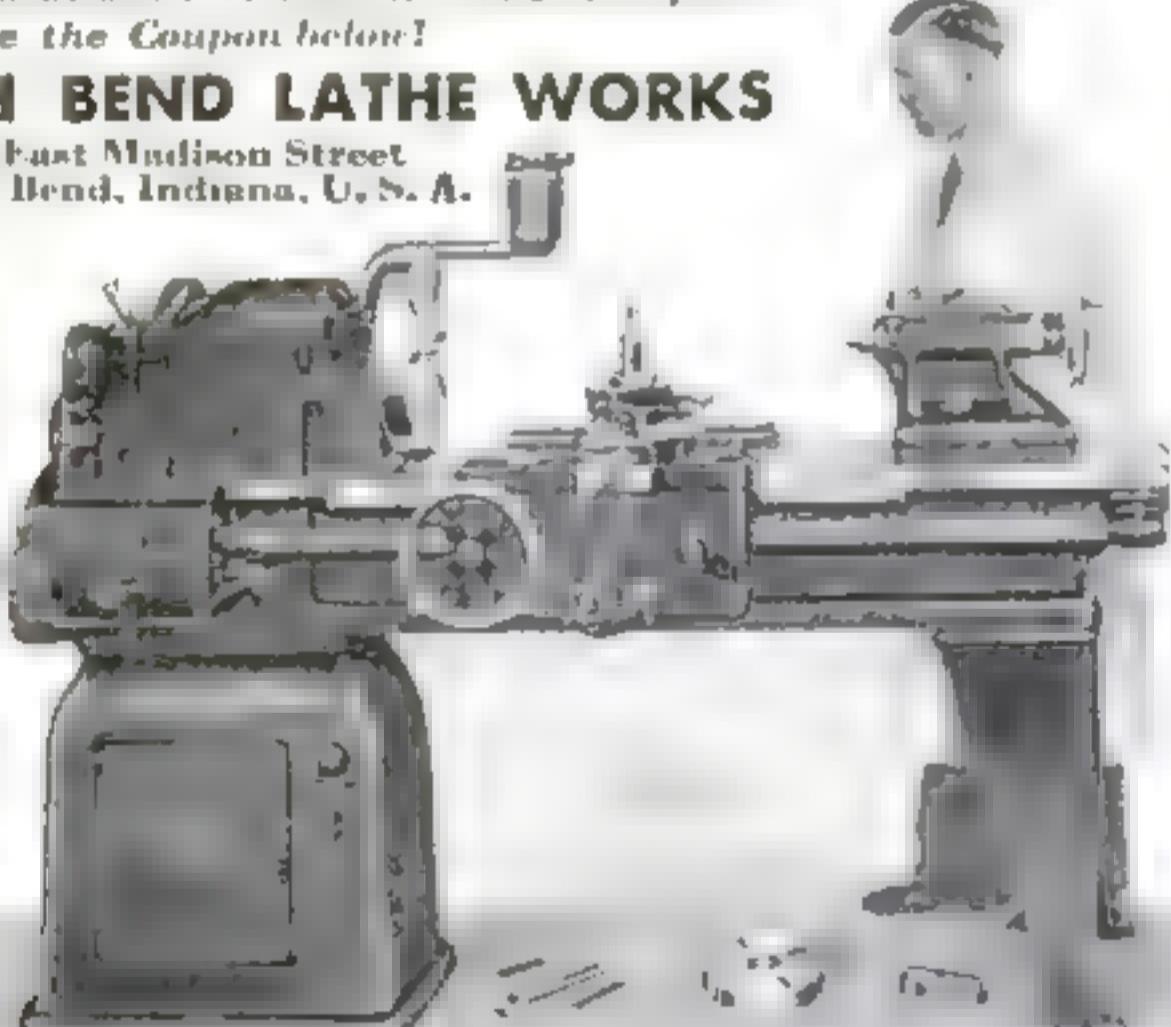
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5 OTHER SIZES—9"—11"—13"—15"—16"
SWING. In all bed lengths. Priced
\$87 to \$1200.

TREE-SHAPED NUT BOWL

(Continued from page 68)



Using drill-press router to finish a squirrel

sanded, and the block taken from the lathe.

Irregular curves are cut with the band saw around the outside as indicated in the drawing of the top view of the bowl. Then the foliage is either carved by hand, with a router in the drill press by holding the bowl in the hands and moving it about under the tool, or with a router and carving bits in the flexible shaft.

The three parts are ready to assemble as soon as holes have been bored through the base and part way into the bottom of the bowl. These holes should be a tight fit for the pins turned on each end of the post.

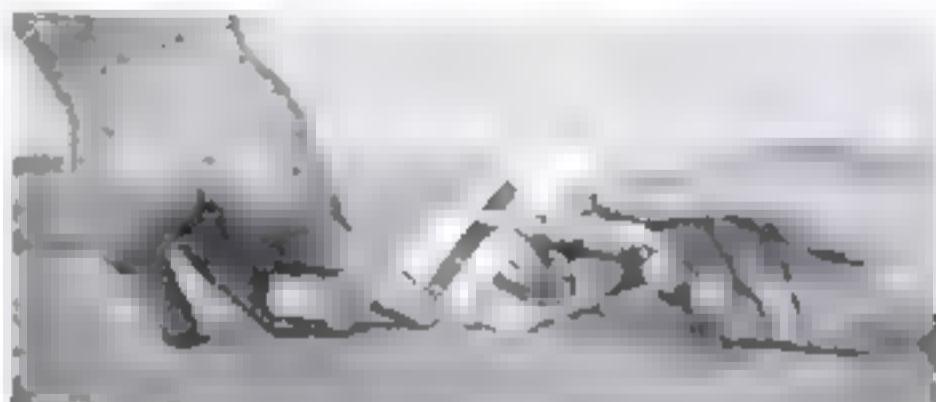
The squirrels are jig-sawed from patterns pasted to 1-in. white pine. The corners are trimmed off with the saw as much as possible to save time in finishing. The final finishing is done with a router and spindle sander on the drill press. If power tools are not available, a round file will do the work very nicely, followed by sandpapering.

The outer edge of the base, if walnut, may be varnished and the center painted green for grass. After the enamel has dried, leaves are painted on in red, brown, and yellow. The trunk of the tree is finished in brown enamel or stain and then shaded with gray and black. The inside of the bowl should be finished in a walnut brown and, if made of light wood, should be stained, varnished, and rubbed down.

For finishing the outside of the bowl, the first coat is yellow enamel. Leaves on the lower branches do not turn as soon as those on the upper and therefore can be touched in with green. Shadows under overhanging limbs are colored brown and black. The upper leaves are touched up by stippling red over the yellow.

The squirrels are stained or enameled brown; the eyes, noses and toes touched with black; and the underparts finished with white or light ivory, blended into the brown. They are fastened with small brads drilled through the bodies and driven into the base or tree trunk—D. C. M.

THICKNESS GAUGE AIDS IN CALIPERING PAPER



WHEN it is necessary to use an ordinary micrometer caliper instead of a paper-gauge caliper to measure the thickness of a sheet of paper, rubber, or other thin, yielding material, a more accurate reading can be made with the aid of a thickness gauge. Simply place the paper or other material between two leaves of the gauge and caliper the whole assembly. The thickness of the object will be the difference between the caliper reading and the combined thickness of the two leaves.—W. C. W.

SOUTH BEND Precision LATHES

NOVELTIES MADE BY METAL TOOLING

(Continued from page 79)



A match-box holder of spring brass with an ornamental face piece of thin modeled copper

it is better to turn the work about rather than turn the tool. In making large circles and square borders, a heavy cardboard template is useful, for you can run the tool around the edge as with a ruler. Since it is difficult to make tiny circles to represent eyes and buttons on figures, use a hollow-point nail set, giving it a very light tap with the hammer.

Occasionally examine the work from the other side. When the design is in high enough relief, turn the foil over and lay it on a smooth, hard surface. With the beveled end of an orange manicure stick, press down the background around the design. Large expanses of background can be smoothed down with a folded piece of paper or a wood spatula. By pressing the pointed end of the orange stick against the outside of the lines, they may be formed in sharper relief.

The final modeling operation consists in turning the foil over and pressing down the metal inside the design. If this is done on a hard surface, the relief will be flat; if done on a newspaper, the relief will be irregular so that, for instance, you can make some parts of a figure stand out more prominently than others.

Clean off all of the petrolatum with gasoline so that the back of the foil can be reen-



Magazine cover of stiff cardboard with name plate applied in the form of embossed copper



How the match-box ornament is first filled with solder, then soldered to the brass holder

forced. There are two good methods by which the reinforcement may be done. If the foil is to be fastened to a wood surface, fill the depressions in the back with plastic composition wood. This can be sanded smooth when it dries and then cemented to any surface. However, if you wish to attach the modeled foil to a metal surface, the best procedure is to flux the back of the foil and fill the depressions with solder, using a soldering iron.

The match-box ornament, for example, was filled with solder in this way. The holder for the match box was made from 0.01-in. shim brass bent to shape and with the corners rounded. It was well tinned with solder before the foil ornament was attached. This was done by sweating the two pieces together around the edge. They were then held together with a C-clamp insulated with pieces of asbestos, the position being changed as each side became soldered together. By applying only a moderate heat in this manner, the temper or "springiness" is not removed from the brass. Under no circumstances sweat such parts together by directly heating the brass; it would become annealed and soft.

The calendar design at the beginning of the article was cemented to a thin piece of compressed wood and a back rest attached. It was made as a gift for a Michigan peppermint grower. Various types of greeting cards



may be made by attaching the foil to stiff cardboard. The monogram design shown is a plate for attaching to the door of an automobile.

Another project is a holder for individual copies of your magazine, to keep it in good condition during the month. Make the covers from one piece of stiff cardboard, creasing it twice at the bend or fold with one of the nutpick tools. Cover the outside with cloth and reinforce the fold with adhesive tape. A piece of wire should be attached from one end of the fold to the other, on the inside, so that the opened magazine can be slipped under it and so held in place. The familiar design on the front was modeled directly from a POPULAR SCIENCE MONTHLY cover, the lettering being clipped and attached with petrolatum to the metal foil. The completed plate was later dipped in a weak liver-of-sulphur solution until it had become a medium dark color. After the back had been filled, the letters were buffed until bright so that they stand out well.



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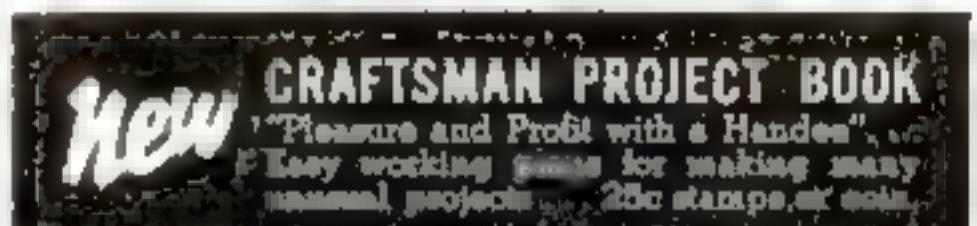


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Yacht Rainbow (7½-in. hull), 233	.25

(Construction kits are available for some of these models. See page 6.)



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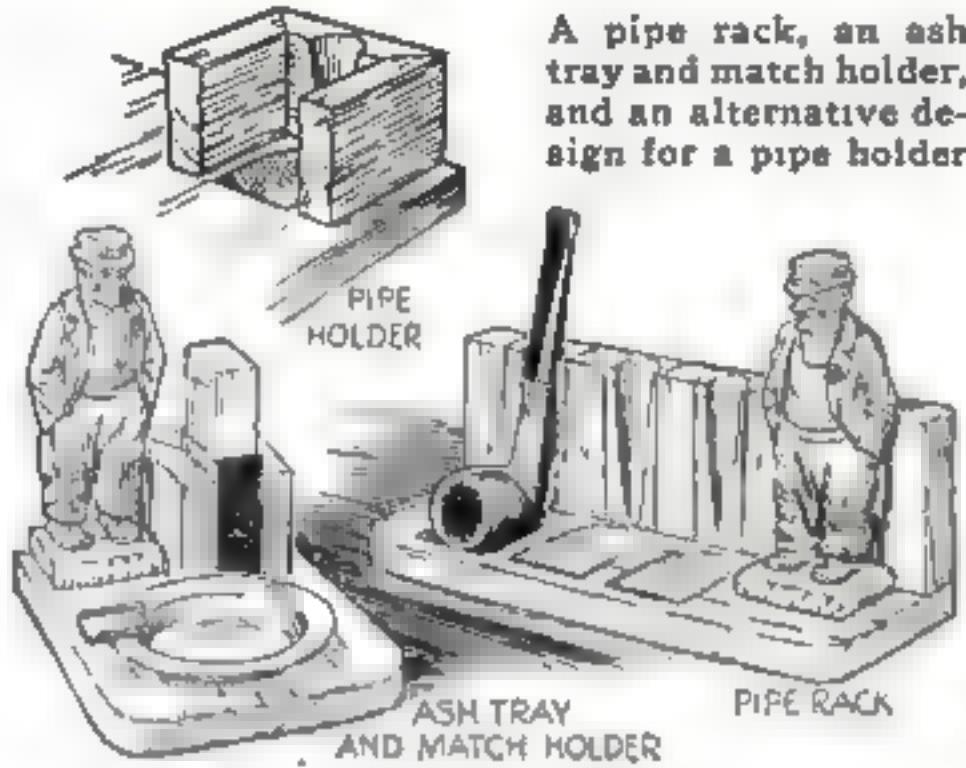
City and State
Please print your name and address clearly.

WHITTLING HOBO HANK

(Continued from page 71)

model face to face with your blank, and sketch the bottom line of Hank's chin and the position of the end of his prominent nose. Cut away the wood over and under Hank's nose, allowing some stock for his hat brim (keep it quite thick at the brim at first, for this part is across grain).

Cut away the wood over the cheeks, so Hank's nose stands out prominently, and shape his jutting chin and jaw. Sketch in the line of his smiling mouth and cut a deep groove to represent it, shaping his upper lip and the deep V below each cheek at the same time. His eyes are also deep V grooves with small cuts on the upper side for eyebrows and a deep pyramidal notch for the pupil of each eye. His ears are like the



upper half of a question mark, and the hair line is just an outlining cut in front of the ear and rounding down in back.

Crisscross his sweater with V-grooves, make curving grooves around the supporting rope, and shape up the flower. Add a couple of grooves for laughter wrinkles and smooth up all details.

The patches on Hank's knees can be put on either in painting or by scratching in crisscross lines. Mix the flesh color for his face from red and white, made weather-beaten as necessary by adding a trace of black. Color his clothes to suit yourself, using black, gray, and a brownish hue made by mixing together white, red, and black. (If preferred, simply stain Hank dark all over, as in the book end pictured, and wax him to a slight polish.)

To make a pipe rack, split the 5 by 9-in. piece lengthwise, join the pieces as shown, and cut notches to fit the bowls and stems of your pipes. Put Hank at one end or in the middle, as you prefer.

In making the book end, saw off 3 in. of the 5 by 9-in. piece and mount Hank on it. The 6-in. piece left should be narrowed to 4½ in., and a section of the waste strip used to simulate the roof on the crude shanty behind him. Hank can be fastened on with screws or short nails.

If Hank is to be a book end (you can use the model for making the second one of the pair), the base should be weighted with lead, or a strip of thin sheet metal should project out from the base in back to pass under the first few books and thus keep the book end from tipping.

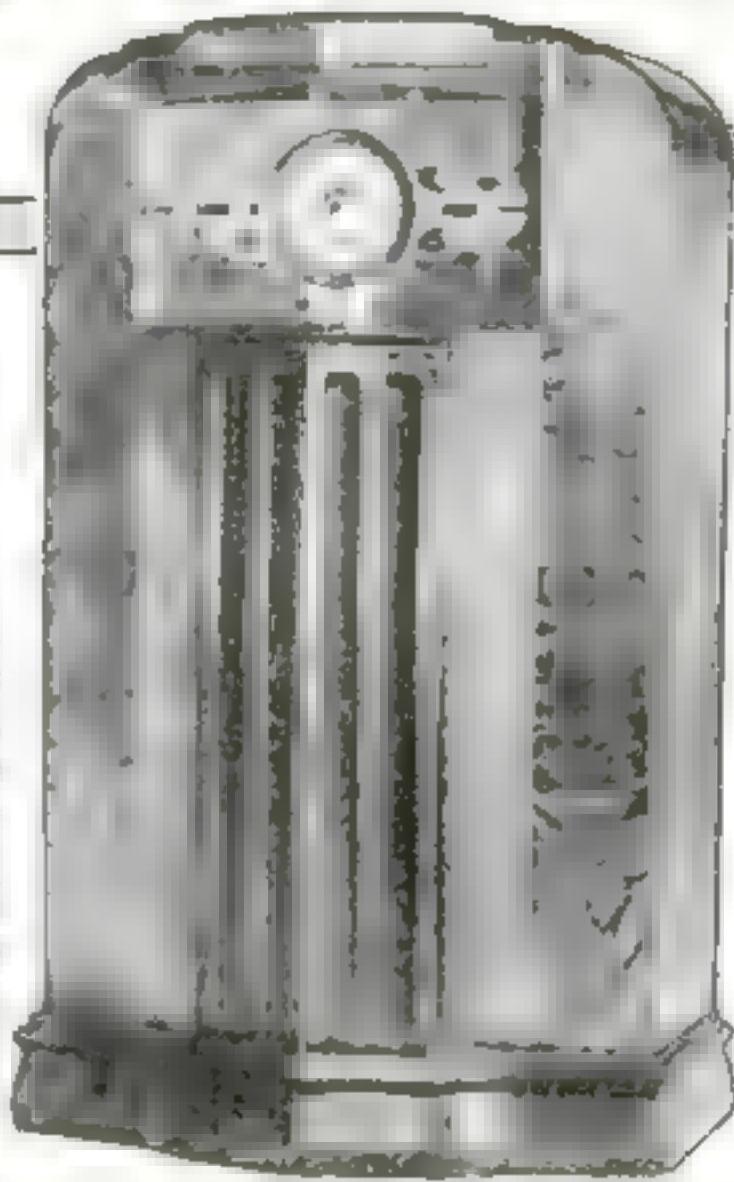
If you want a pen set, buy an inexpensive desk pen and use the socket from it, or simply drill a hole in the base large enough to receive the cap of your regular fountain pen.

To make the ash tray and match or pipe holder, cut the 5 by 9-in. piece as before, using the 6-in. piece for the base and the 3-in. piece to form a supporting frame for the match box or a pipe. Cut the circle in the base to fit the ash tray, or simply set the tray on top. The standing part in back can be carved to simulate a fence, or an old box or a crate, and the whole painted or stained.

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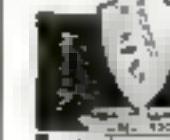
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IF YOU know any particularly good construction kinks to be used in building an auto camping trailer, here is a chance to cash in on them. We want you to tell us about your best, most practical, and most economical methods so we can pass them along to the many other readers who are planning to build trailers of their own this spring. To make it worth while, we will give \$250 in cash prizes for the best ideas submitted, as follows:

First prize.....	\$100
Second prize.....	50
Third prize ...	25
Fourth prize.....	15
Fifth prize.....	10
Sixth to fifteenth prizes, \$5 each.....	50
Total.....	\$250

All you have to do to enter the contest is to write 500 words or less describing some



construction method that will help others in building a trailer. Then make a clear, accurate pencil sketch or drawing, or take a photograph or two of the job, or better still, do both. Mail the illustrated description to reach the Trailer Contest Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, on or before February 1, 1937.

Remember that you don't have to tell how you build the complete trailer. Concentrate on the one best kink you have developed—the one that saved you the most time, labor, or material, or the one that makes the greatest improvement in the strength, roadability, safety, convenience, or comfort of the trailer. In other words, what was the outstanding feature of your work?

It may be, of course, that you have discov-

ered several unusually good methods. In that case, don't try to crowd them all into one entry. Make each a separate entry. You can enter as many individual construction kinks as you wish, provided each complies with the other rules.

Your entry or entries may relate to any part of the work of building a trailer. For example, you may have assembled an economical running gear, devised a good way to rig up power brakes, designed a simple but efficient hitch, made unusually convenient parking legs, assembled an especially light, strong frame, or discovered other good ideas relating to the chassis.

On the other hand, perhaps you purchased a drop axle, wheels, brakes, and hitch ready-made and used your ingenuity on building a good body. Very well. What have you to offer in the way of methods for setting up and bracing the frames and roof, laying the floor, covering and insulating the walls and roof, making doors, windows, and screens, applying the trim and hardware? Any good ideas relating to the construction of the body are eligible.

Finally, the interior fittings and equipment offer another wide field in which to submit ideas. How about the kitchenette, the bunks, the electric fixtures, the stove, the sink and water supply, ice box, radio, and cupboards? A good kink relating to any of these or similar subjects would comply perfectly with the contest requirements.

The contest is open to all except employees of POPULAR SCIENCE MONTHLY and their families. The judges will be the automobile and home workshop editors of this magazine, and their decisions will be final. In case of ties, each tying contestant will be awarded the prize tied for. No contributions will be returned. Be sure to address all entries to the Trailer Contest Editor, and don't delay. The closing date is February 1, 1937.

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PAINTING INSIDE WALLS

(Continued from page 93)

niture with soft, blue-toned side drapes on the windows and a rug having a series of soft blue, red, brown, ivory, and grays. This color series then predetermines to a large extent the choice of our scheme for a four-color Tiffany glaze.

In every mass of color there are four normal areas of value: the bottom quarter, which is deepest or darkest; the next highest, which is medium; the third highest, which is light; and the fourth upper area, which carries the least color of all. An analogy may be daily found in any landscape where the earth occupied the lowest area; the bushes and flowers, the second; the tops of the trees, the third; and the sky, the fourth and lightest area.

BY MAKING use of this normal balance, we have a basis for producing our color values on the wall portions. A tannish brown, with a trace of slightly greenish areas, would occupy the lower quarter; another series of areas, slightly brown but with more green and a hint of orange or red, in the second portion; a very slight hint of brown and of green with more occasional orange or red traces and a final hint of blue in the third quarter; and an occasional hint of blue here and there in the topmost portion.

First, make up a series of four pots of color, using small tin cans or mayonnaise jars half full of good four-hour enamel of the colors you wish to use. Thin each portion of enamel with an equal amount of "flatting oil," which you can buy at all paint stores selling paste lead in oil, and stir thoroughly. Provide a small brush for each color, and have a separate piece of rag pad for each color.

Next make up a board with a handle nailed to the bottom center as shown in one of the photos. A piece of the end of a broom nailed to a square of heavy cardboard from a shipping case will do, but a piece of sheet metal is best of all.

START with the tan and put a generous brushful on its allotted area of the palette. Make up a pad that can be handled between the thumb and two fingers of the right hand and tie in shape with a rubber band or string. Rub the rag pounce in the tan color and then use an irregular rolling motion to apply it to parts here and there on the wall. Step back a few feet and take a look at it. If the color is heavy and definite in outline, blend it out thinner with the rag pounce. Step back and look again. Use your judgment from now on. With a wide, dry brush, stroke the color area sideways and up and down before the color sets. The brush treatment blends and softens the color to a fog, which is what is wanted. A separate clean, dry brush must be used for each color and never interchanged.

Now try another color, the green, spreading this here and there above the brown and once in a while among the tan color fogs. Blend out the colors carefully. Step back a few feet and study the result. A bit heavy over there, it needs blending with a dry brush. A little more color here, perhaps. There, that's just right!

Here again the lady of the house should be called in for help, because you are so close to the job that you lack the proper perspective. Your wife can be far enough in the rear to see the effect as a whole and guide you accordingly.

Be very careful indeed with the orange or red, otherwise you will overdo the whole color scheme. Make these colors just a suggestion and no more.

Last of all, work in the blue, remembering how fuzzy clouds look on a summer day. Now, give it all a critical inspection. We can all do artistic work if we get a chance, and this was yours. How does it look?

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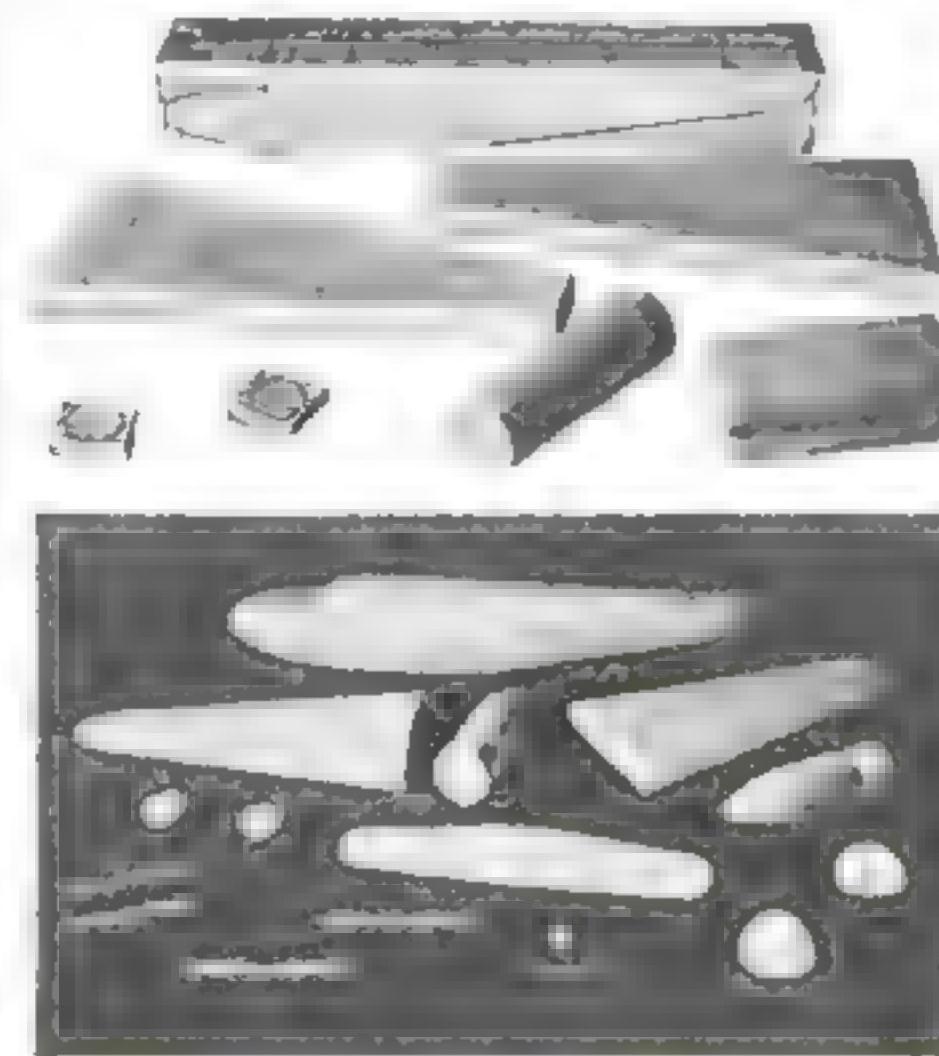
(Continued from page 77)

course, be done on a smooth, level surface. Brace wires (thread) may be added.

The color scheme: Fuselage, vertical tail, and all struts, dark green; wings, horizontal tail, and pontoons, yellow; windows and all trim, black.

In contrast to the seaplane just described is the low-wing Kinner Sportwing. It is a fast sport plane with two seats placed side by side.

General specifications of the airplane are as follows: Span, 34 ft. 5 in.; length, 24 ft. 6 in.; height, 7 ft. 2 in.; weight empty, 1,397 lb.;



Parts for the Lockheed model ready for assembly; above, the blanks before being shaped

useful load, 773 lb.; fuel capacity, 42 gal.; engine, Kinner R-5, series 2, 100 h.p. at 1,850 r.p.m. Performance: Maximum speed, 132 m.p.h.; cruising speed, 120 m.p.h.; landing speed, 45 m.p.h.; service ceiling, 17,950 ft.; climb per minute, 1,100 ft.; cruising range, 510 miles.

Thirteen main parts are required for the model, or twenty-five in all. The wings are braced on top by two V-struts. The wheels are braced with small struts. There are also two braces for the wing stubs just above the landing gear (shown in dotted lines on the front view). These may be added if the builder desires to go into more detail. Using cardboard for the tail units and the wing struts, and detail drawing paper for the windshield, simplifies the job a lot.

Glue the cylinders into holes drilled in the nose of the fuselage and also fasten the "pants," wing struts, windshield, and tail group in place with glue.

Paint the entire plane light blue and trim with black or, for a more varied color scheme: Fuselage, "pants," and vertical tail, dark blue; wings, wing struts, and horizontal tail, yellow; tires, cockpit, engine, and trim, black.

A SET OF BOARDS FOR DUPLICATE BRIDGE

(Continued from page 65)

numeral is lettered in the center. "Dealer" is indicated by lettering in the proper place on the front in white enamel or gold, and an appropriate arrow with an "N" shows the direction of north. The composition board need not be finished, but the lettering should be preserved with a coat of varnish or shellac.

A piece of felt, preferably black or green, is cemented to the bottom of each board, after a 1-in. circular hole has been cut in the center to reveal the number.

The pockets were designed for standard 2 $\frac{1}{4}$ by 3 $\frac{1}{2}$ in. playing cards. Use a card as a template during construction, and be sure that there is a clearance of 1/32 in. on each side.



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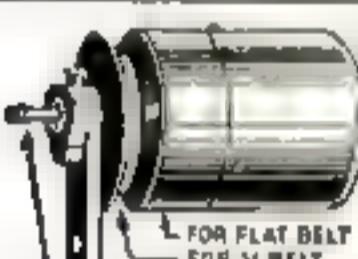
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A LOW-COST ENLARGING CAMERA

(Continued from page 84)

BASIC DIMENSIONS FOR ENLARGERS

NOTE: Dimension *a* is the distance in inches from the lens to the projection paper; dimension *b* is the distance from the lens to the negative.

Amount of enlargement	Focal length of lens in inches							
	3	3½	4	4½	5	5½	6	7
<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>
twice	9 4/5	10 1/2	9 1/4	12	13 1/2	15	18 9/16	21 10/16
3 times	12 4/5	14	14 2/3	16	18	20	24 1/8	28 9 1/3
4 "	15 3/5	17 1/2	17 1/2	20	22 1/2	25	30 7/16	35 8 3/4
5 "	18 3/3/5	21	4 1/5	24	4 4/5	27	33	36 7-1/5
6 "	21 3/5	24 1/2	4 1/12	28	4 2/3	31 1/2	38 1/2	42 8-2/5
7 "	24 3/3/7	28	4	32	4 4/7	36	44	49 8-1/6
8 "	27 3/5	31 1/2	3 15/16	36	4 1/2	40	48 6-6/7	56 8
					40 1/2	45	54 6-3/16	63 7/16

the correct location for the globe, so mark the measurement carefully on your sketch.

It will probably be necessary to solder a section of a tin can or an aluminum cup to the reflector to hold the socket in the proper position when building the lamp house. While this beam will not be entirely even, due to the "hot spot" from the globe itself, it will be good enough, as the opal glass will further diffuse the light.

Although instructions are given from time to time for the construction of bellows, I have found it difficult to get just the right materials and adhesives to make a really efficient one and prefer not to try to make this part. The bellows illustrated were picked up with part of an old camera in a second-hand store for twenty-five cents.

A focusing device such as a rack and pinion is a great aid when using the enlarger. A friend of mine made a rack by annealing and straightening out the rim of a gear, but this was beyond me, so I hit upon the substitute illustrated, which works very well. A spindle is passed through two brackets fastened to the sliding lens front, and a small pulley is fastened on either side, outside the brackets. The spindle projects a little farther at the right side so that a knob can be attached for turning it. Then a piece of 30-lb. silk fishing line is passed once around each pulley and fixed at each end to stationary parts of the enlarger, as illustrated. As the spindle is turned by means of the knob, the sliding front moves smoothly up or down. All these parts were taken from a model-engineering set. The lens-holding front fixed to the slide in this case was taken off an old camera, but it can be easily duplicated by the woodworker.

To avoid damage to the enlarger (when erected vertically) from slipping down the main slide and to facilitate its use, it is well to counterbalance the entire enlarger assembly with cord, weights, and pulleys.

While the enlarger is best if fastened to a wall in the darkroom, it may, if you do your developing in the bathroom or kitchen, be made portable by fastening the slide to a baseboard.

A few general suggestions may be added to help in the practical work of building your enlarger:

The lamp house is best made of tinned iron, because it is easy to work and reflects well. If it is more convenient to use some other metal, paint the inside with aluminum or white paint. The inside of all light-vent shields, the outside of the enlarger, and the inside of the negative house should be painted dead black, to avoid reflections. The negative house should be made from well-seasoned wood.

Avoid all possible light leaks, and shield vent holes inside and out. If there is still some light getting by, see that it is directed upward. The smallest leaks, if facing the sensitized paper, are dangerous. Place a strip of felt in the joints where the different sections of the enlarger come together.

See that the lamp house is well ventilated. This will lessen the danger of ruining a dense

negative when prolonged exposure is necessary.

For governing the exposures, use a switch that is not rigidly connected to the enlarger; that is, a pendant or foot switch. This will prevent the setting up of vibrations when snapping the current on and off.

Lens, paper, and negative must be parallel. The only exception to this is when correcting verticals or distortion; in this case the lens is stopped down to obtain sufficient depth of focus to allow the sensitive paper to be tilted from its usual plane.

For methods of using an enlarger, see "Making Your Own Enlargements" (P.S.M., Mar. '33, p. 72), "How to Shade Your Photos" (P.S.M., Dec. '34, p. 78), and "Speedier Ways to Make Photo Enlargements" (P.S.M., Jan. '35, p. 78).

HOW TO TEST ALIGNMENT OF A YACHT MODEL



IN THE construction of a model racing yacht, a practical and simple method for determining the alignment of hull, keel, and skeg is that illustrated above. It will prevent inaccuracy in any of these parts, which would seriously affect the sailing efficiency of the finished craft.

The model is turned upside down and carefully leveled on a table. Two posts are erected at opposite ends of the table top, and a line is strung between them. A plumb line, suspended from a brass hook, can then be dropped anywhere along the boat. The preliminary step is to drop the plumb at both the stem and the stern so that the hull can be perfectly centered under the line. Even minor errors can be detected by sighting along the length of the boat.

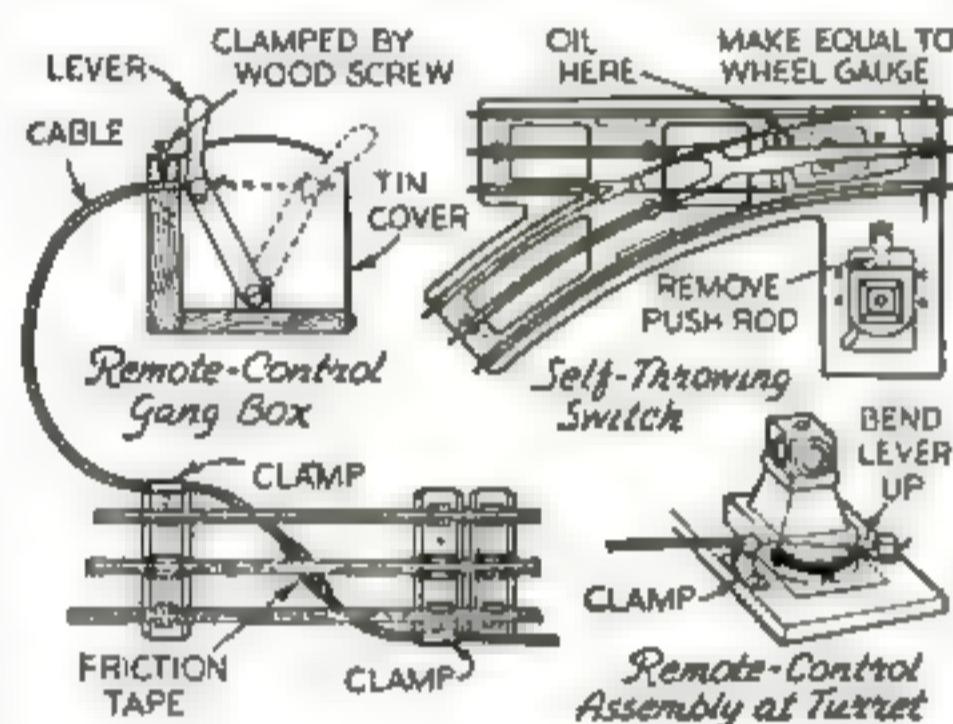
The hull might also be placed in a horizontal position on a wall and a plumb line dropped square from the stem but clear of the keel, and sighted for alignment.

A counterbalanced traveler can be swung on the line, and plumb lines dropped to different points on the hull. By reversing the carriage, equidistant points on the opposite side of the hull can be spotted for high or low points. Of course, the rigging must be used in conjunction with templates and is not suggested as a substitute.—WALTER K. MOSS.

SIMPLE REMOTE CONTROL FOR MODEL RAILWAY

IN REMODELING and improving a model railway, the conversion of local-control switches into the distant-control type is difficult and somewhat expensive if done electrically. For each switch a large double solenoid, wound with many turns of magnet wire, is required. These are rather hard to make and mount neatly. The outside rails must be insulated, and there is always the danger of a short circuit that may burn out an expensive transformer.

The mechanical system illustrated is much simpler and more foolproof. It is made up with automobile push-pull dash controls, which may be picked up in any salvage yard for small change. The flexible tubing is run along the rail line and clamped at intervals



Methods of installing remote-controlled and automatic switches without elaborate wiring

(it may even be left loose, if desired). Only where it is necessary to cross under the track is any caution necessary. The third rail must be protected as shown.

The switch lever should be bent to miss the notches used to hold it in place for manual operation. If, in addition to this, the moving parts are oiled, the controls can be operated over a long line of track. Short cables may be spliced into long ones by splicing the center wire and clamping a guide casing made of tin or copper tubing over the flexible loom through which the wire runs.

The controls may be ganged into one box, either the original controls or lever controls being used. This box need not be fastened to the track in any way, the only essential being that the flexible loom is clamped firmly to box and to switch base. If the wire buckles when the lever is pushed, the pushing action may be assisted by a spring of any type, placed in the turret base.

The self-throwing switch is made by simply removing the push rod to the turret box. It will then be found that the piece with the movable rails is so free-acting that the wheels of the lightest flat car will throw it if approaching from an open line.

It might appear that the switch will be left "straddling" after the first throw. This will occur only if the track gauge is considerably wider than the wheel gauge of the widest piece of rolling stock that passes over it; and if this is the case, the trouble may be completely remedied by bending the outside rails inward. Do not bend the movable rails piece.

Some older switches of "stub" design are not adaptable, but all modern switches of the "split" type will work properly. Obviously, the same switch cannot be made self-throwing and remote-control at the same time, but this is no disadvantage in a well-run model railroad system.

With the self-throwing type of switch, the train may be run continuously on a single line of straight track with a loop at each end. This is one of the first stunts usually exhibited by the owner of a set of electrically controlled switches.—JOHN L. STORY.

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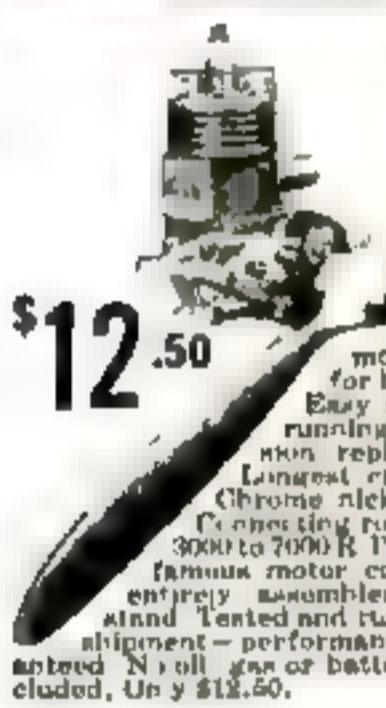


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ROCKFORD CLUB BUILDS SCOUT CABIN



The limestone fireplace, the fire "basket," and the wood holder were all made by members

Did you ever try building a log cabin, when the only logs in sight are park trees and it would mean a thirty-day sentence to be caught taking even a single hack at them? And did you ever try matching two logs together, one shaped like a corkscrew and the other like an oxbow? Try it sometime.

The Rockford (Ill.) Homecraft Club not only tried it, but did build a cabin under those conditions (see the photos and plan on page 67).

In the fall of 1934, a proposal was made by the local post of the American Legion that if the club would build a log cabin for the Legion Scout Troop, the post would furnish the necessary materials. It was agreed that the cabin was also to be used by any Boy or Girl Scout troop in Rockford. The club accepted the proposal and at the same time decided to enter the cabin as a club project in the 1935 National Homeworkshop Guild Exhibition, where (although not yet completed) it subsequently won a silver cup and first prize of \$100 in the club project division.

A site was donated by the Park Board just outside the city limits on the bank of Rock River, beside a beautiful sunken garden. Old poles were donated by the local power company; stone and fill by the city administration; and lumber, cement, and other materials by local business concerns.

The cabin plan is L-shaped, 30 ft. on the long side and 20 ft. at the widest end. The underside of each log was channeled to fit the log below, and the corner logs were notched on the underside to fit. This was necessary because of the great variation in the size of the logs. Some of the logs were as much as 18 in. in diameter at the butt, and others as small as 8 in. Insulation was laid between the logs as fast as they were put up.

The only opening left in the logs at first was for the fireplace. Doors and windows were marked and cut after all the logs were in place. The windows are all single sash, with an outside removable covering for protection when the cabin is not in use. The rafters are covered with tongued-and-grooved roof boards and asbestos shingles.

Quarry-run, hard limestone was used for the fireplace. The Boy Scout emblem was cut and donated by a local stonemason and was laid in after the fireplace had been completed. A fire "basket" and a hammered iron holder for firewood were constructed by several of the members. These accessories can be seen

in the accompanying photo of the fireplace.

The efficiency of the fireplace was well demonstrated when the club held a meeting in the cabin with the temperature at 20 below zero. The cabin was comfortable the entire evening.

With appropriate ceremonies the cabin was turned over to the Boy Scouts by Robert A. Horner, who represented both the club and the Legion, and by Barney Thompson, who represented the community. It was accepted by A. A. Stocker, commissioner of the Blackhawk area of the Boy Scouts.

To drive down North Second Street in Rockford almost any evening in summer and see a group of boys sitting around a camp fire with their scoutmaster is compensation for all the time and effort spent in building the cabin. It is full justification for the homecraft idea.—F. K. BAILEY, chairman, Rockford Homecraft Club.

MANY WORKSHOP CLUBS REPORT ACTIVITIES

HERE are the latest reports from clubs affiliated with the National Homeworkshop Guild:

Springfield (Mass.) Model Yacht Club. Designs of three yachts in the 50-800 or Marblehead class have been selected for the winter's work, and competition will be keen next spring upon completion of the models. The club attended the 50-800 class national championship races at Elizabeth, N. J., in October. Yachts were exhibited in several hobby and home workshop shows in the vicinity of Springfield, and some models have been on display in leading store windows. Arrangements are being made with the Park Commission for a sailing area on Porter Lake, Forest Park. New members are desired, but interest in building and sailing 50-800 or A-class boats is a requirement. The officers are Richard T. Carothers, commodore; Earl C. Gilman, vice commodore; Joseph H. MacNeill, secretary; Leslie G. Mann, treasurer; Stanley M. Kenerson, librarian; Fred E. Arens, steward.

Saginaw (Mich.) Homecraft Club. The club exhibited in the Saginaw County Fair and then displayed most of the projects in the windows of local hardware stores. Considerable interest was aroused, and several new members were added. . . . The Christmas toy project has progressed rapidly. Three lumber mills donated the materials.

Creston (Iowa) Homeworkshop Club. Officers elected for the year are H. G. Beatty, president; C. H. Thomas, vice president; A. Fred Watts, secretary-treasurer; A. S. Beatty, librarian. "Our club has already started on its third year," Mr. Watts writes, "and we are very proud of the work done by the members, but more especially of the public service by the entire club in making Christmas toys for poor children."

Brookhaven (Miss.) Homecraft Club. Meetings are held every Wednesday with an excellent attendance. Fourteen power machines have been bought by members since March 1. Plans were made recently to exhibit at the local county fair.

Cartier Homeworkshop Club, Montreal, Canada. Because no regular meetings are held during the winter, a bulletin will be published periodically to keep the members in touch with one another. It is edited by the secretary, Paul Denis. . . . Jean Tremblay has been named chairman to arrange for a club exhibition. He recently began work on a railway layout in cardboard. The track is 48 in. square, and the locomotives and cars are only 4 in. long.

Stout Arts and Crafts Club, Menomonie, Wisc. Last year's (*Continued on page 99*)

GUILD CLUB ACTIVITIES

(Continued from page 98)

hobby show was such a success that the club plans to sponsor one every year. Meetings are held weekly for the discussion of hobbies and new ideas, and these talks are followed by workshop periods. Through its alumni who are out in the teaching field, the club has done much to spread the idea of cultivating a hobby. Walter R. LaTondresse is president; George Pease, vice president; Keil Blank, secretary; Arthur Mather, treasurer.

Lawrence Homeworkshop Club, Philadelphia, Pa. There are nine charter members in this new club. Harry William Rundgren is president; Carl Kuhnle, vice president; Raymond Shaw, secretary; Earl Barber, treasurer.

Civic Homeworkshop Guild, Fort Wayne, Ind. The club has been presenting programs about phases of the home workshop hobby every Tuesday night over station WGL. . . . At the annual meeting Lloyd N. Smith was elected president; A. J. Brueggeman, vice president; C. E. Howe, secretary; Cleo Kramer, treasurer; A. K. Gearhart, librarian. The board of governors consists of William N. Ballou, C. G. Rinehart, and A. H. Stoner.

Shenango Valley Homeworkshop Club, Sharon, Pa. The following officers were elected at the annual meeting: R. T. E. Bowler, president; J. A. Bock, vice president; N. F. Klopp, secretary-treasurer. On the board of governors are F. N. Newton, Jr., R. C. Martz, M. J. Martin, and Mike Bebech.

Galesburg (Ill.) Homeworkshop Club. Roy Landon, instructor at the local high school, recently gave a demonstration on using the lathe. . . . W. W. Knowlton, president, has built a blueprint frame and distributes prints at each session.

New Bedford (Mass.) Woodcraft Club. Edward F. Frawley, financial secretary, entertained the club with a clambake at his summer home. Three members of the Fall River Homecraft Club were guests. . . . Felix Plouffe has been appointed librarian. All plans received from the Guild are blueprinted and placed in the club library. . . . An exhibition will be held in February, and each member must display at least one article he has made during the winter.

Mount Vernon (N. Y.) Homeworkshop Club. Herman Hjorth, teacher, craftsman, and author, gave a demonstration of spiral turning before the Mount Vernon and Peekskill clubs in the William Wilson High School recently. The visitors were welcomed by George Herman, president, and Joseph Dickman, secretary. A plaque made by a member was won by Lester Jessup, of Peekskill. . . . An extensive program is planned for this year. Through affiliation with the Mount Vernon Recreation Commission, the club has obtained the use of the attic of the local Arts and Craft Building. The new meeting place is being outfitted with motor-driven machines. Members and visitors who do not have their own workshops will be allowed to use the club shop.

Fall River (Mass.) Homecraft Club. The members have spent the fall months working on the club's Christmas toy project. Approximately 175 toys were completed. Bernadine Lafond was chairman. . . . George Lagault demonstrated the different uses of the planer at a recent meeting held at the home of Clifford Schlemmer.

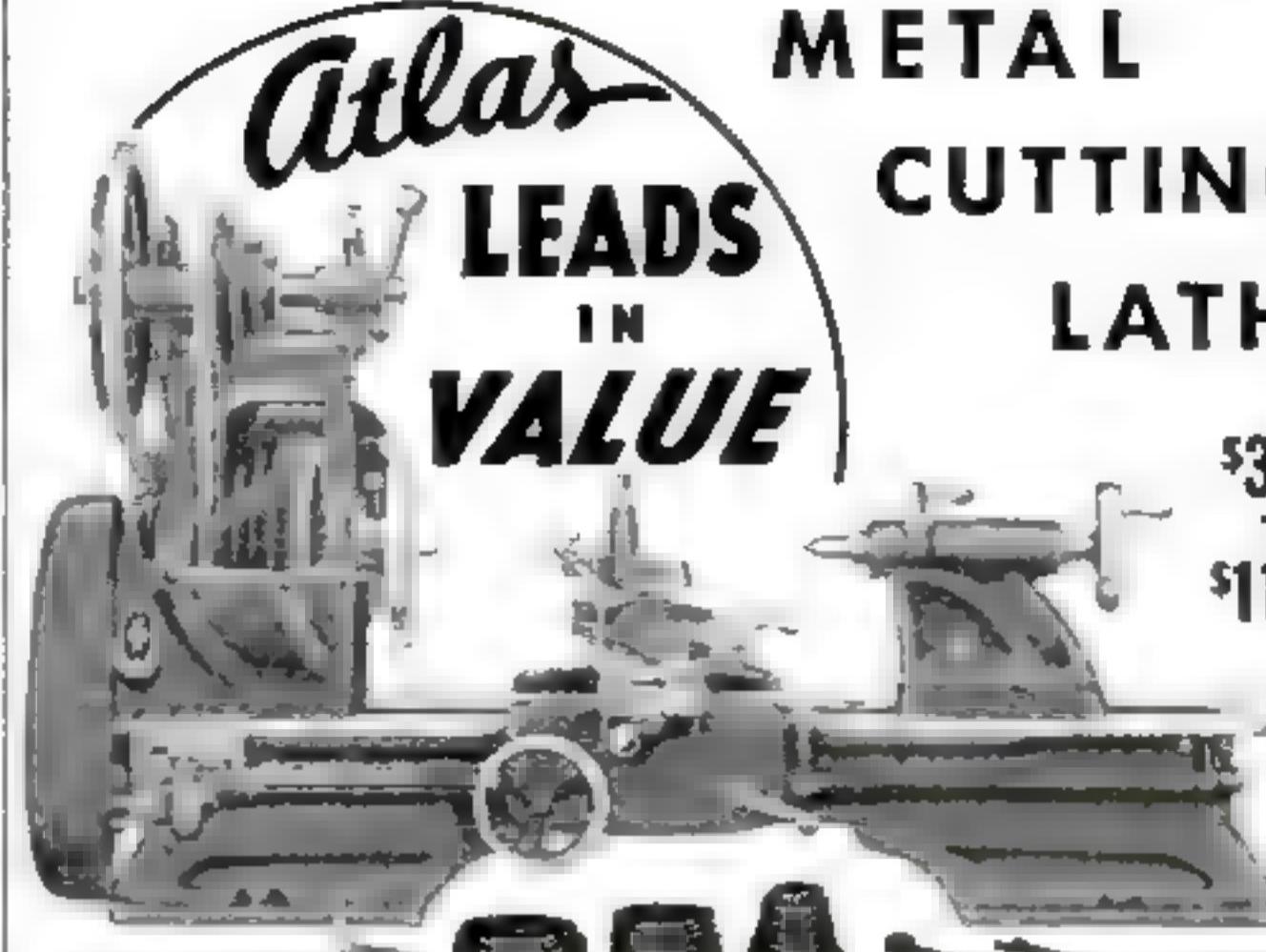
Coulee Dam (Wash.) Homeworkshop Club. Types of joint construction and various kinds of tools were discussed at the home of the president, Ross K. Tiffany Jr. Two new members were admitted. They are John C. Breelove, who is building a model railroad with two of the cars completed already, and W. C. Chubbuck, who is interested in the metal working arts and has built two small forges. Plans are being made for an exhibition this winter.

(Continued on page 100)

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GUILD CLUB ACTIVITIES

(Continued from page 99)

Edison Homeworkshop Club, Chicago, Ill. The first club contest having been so successful, plans are being made for another next spring. Officers for the new year are E. M. Dittmer, president; C. F. Wetzel, vice president; A. H. Fonke, secretary-treasurer. On the board of governors are L. H. Juhnke, Earl Getchell, and I. W. Streng.

Queen City Craftsman Club, Cincinnati, Ohio. As a group project, the club intends to build a model of the Cincinnati Amusement Park. . . . John Westerman, secretary, has completed a model of the U. S. S. *Preston*.

Club des Artisans Amateurs, Trois Rivieres, P. Q., Canada. Pierre Lemieux has made a complete hunting scene using only a pocket-knife as a tool. S. O. Balleux, president, recently made a projector for the club to use.

Lamesa (Texas) Homeworkshop Club. R. A. Stuart has begun construction on a 72-in. gas experimental plane. He is in charge of the model building division of the local high school crafts club. . . . L. P. Stark has completed a single cylinder two-cycle gas engine, casting and machining all the parts in his shop. He recently demonstrated metal turning and boring before the other members. . . . The club has been sponsoring a series of model airplane contests.

Ship Craft and Model Engineering Guild, Cincinnati, Ohio. A campaign for new members is being conducted. The club is open to men eighteen years of age or older. It is sponsored by the Public Recreation Commission of the city, the director being William Richards, an experienced model maker and naval architect. Among the members are men interested in making split bamboo fishing rods, model gas planes, model railroads, model sail and power boats, decorative models, and other craftwork. . . . A club project involving the construction of a model train has been started. The purchase of several machine tools is being considered.

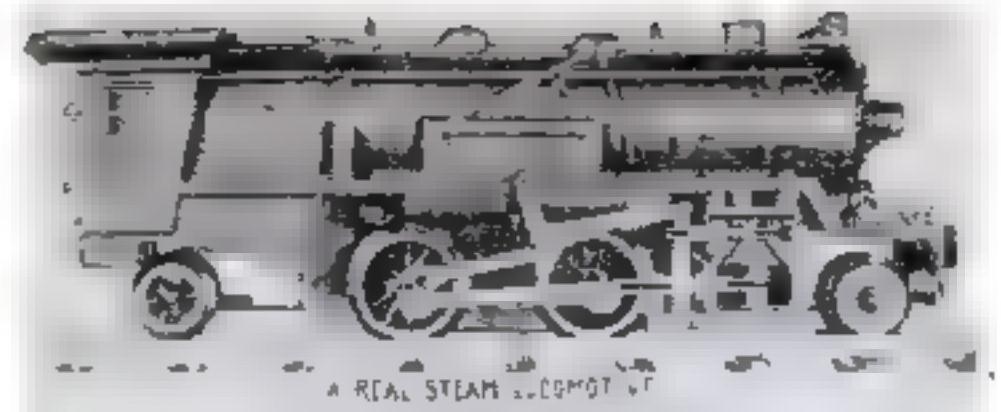
Union County Craftsman's Guild, Elizabeth, N. J. The members have been constructing toys for distribution at Christmas through relief agencies. G. J. Mack, Jr., E. E. Muzik, and F. E. Phares designed the toys. . . . Permanent headquarters have been established at the shop of A. R. Hopkins. Programs at recent meetings have included a talk on fishing rods by C. Z. Herrmann and demonstrations of wood finishing and use of a hand grinding tool, as well as a trip through a machinery plant at Plainfield.

Premier Homeworkshop Club, Chicago, Ill. Plans have been started for the club's annual exhibit. Meeting headquarters have been established at the River Park Field House. . . . Alexander Maxwell recently built a model railplane that runs under the power of a propeller. Henry Wagner has completed an inlaid card table with a checkerboard center.

Toledo (Ohio) Homecrafters. A contest is being conducted, the best project to be awarded five dollars. Most of the club activities for the past few months have centered around the construction of Christmas toys.

Berkshire Homeworkshop Club, North Adams, Mass. Articles made by members were exhibited at the Great Barrington Fair. Seven airplane models displayed by Everett Barton, secretary, were awarded a third premium, while turned candlesticks by Beryl Barton took a second premium. . . . At a recent meeting each member selected a project to build from the Guild instruction sheets, and a prize will be awarded for the best constructed article.

Mount Morris (Ill.) Homeworkshop Club. LaVern T. Ryder, first president of the National Homeworkshop Guild, helped to organize this club recently. W. G. Colvin is president; Hec Mann, vice president; Paul J. Yoe, secretary-treasurer.



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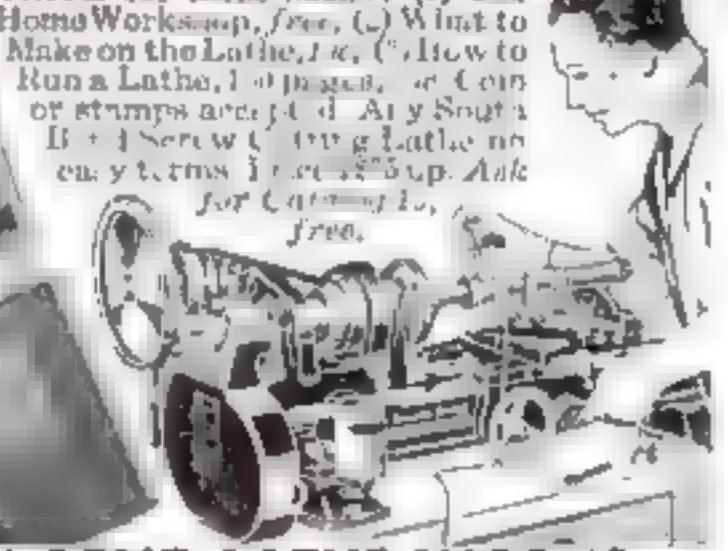
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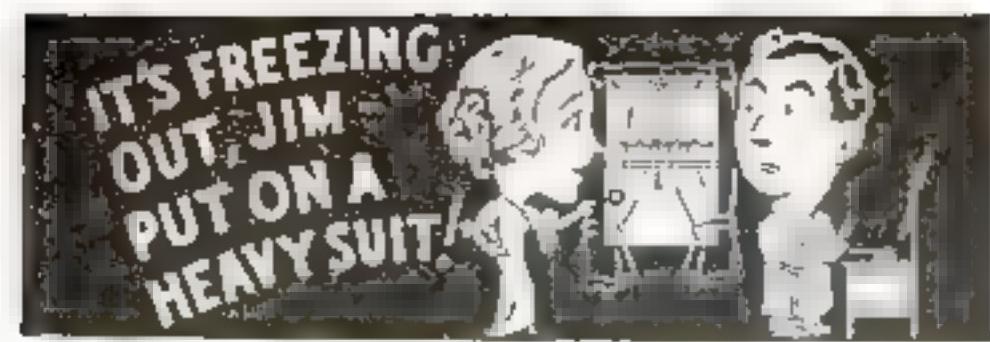
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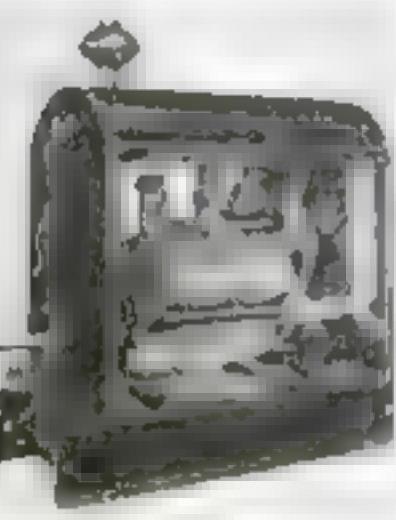
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YOUR CHRISTMAS TREE UNDER THE MICROSCOPE

(Continued from page 49)

blade, so that the sections, when cut, will float in it. Use a straight razor or a safety-razor blade in a suitable handle.

In a cross section of the leaf you can note the following features: The thick skin, or epidermis, designed to retard moisture loss; directly beneath it, the sclerenchyma, or rigid tissue; next, a wide band of green cells with infolded walls, and with resin ducts among them. These ducts are large, and open at the center. In the center of the leaf is a region of cells, mostly empty, with usually two fibro-vascular bundles near the center of each half of the region. Some of the cells contain protoplasm. This part of the leaf resembles somewhat the wood of the pine stem, and you can see elementary medullary rays. If you are lucky enough to slice one of the breathing pores in the middle, you can see the air chamber in the green tissue, and the two green guard cells below the epidermis, flanking the opening.

ALTHOUGH, because of the season or other circumstances, you may not be able to obtain suitable specimens of cones and spores, you most certainly can procure a twig or two from the nearest Christmas tree, and some pieces of pine wood from an old packing case or the scrap pile of a woodworking shop. Many microscopists find the wood the most fascinating part of gymnosperms to study.

It is not a difficult trick to slice a twig one eighth inch or so in diameter into sections thin enough for microscopic examination. The only tool you need is a sharp razor. Usually, the slicing can be done easier if the twig is rested on a piece of cork, a soft-wood block, or a sheet of cardboard. Guide the razor with the forefinger of the hand with which you grasp the twig, and cut the sections as thin as possible. For ordinary examination, the sections can be placed in water. A water-glycerin mixture, or pure glycerin, will preserve the sections for a long time under a cover glass. For permanent mounts, the sections must be fixed, stained, and mounted in balsam. Stem sections usually can be fixed by placing them for an hour in absolute alcohol. They can be stained in alcohol-, water-, or oil-soluble dyes; or even with commercial wood stains, and mounted in balsam. Tangential sections of stems can be made simply by whittling the wood with a razor so as to produce chips as thin as possible.

An ordinary block plane or small smoothing plane such as carpenters use will serve as a microtome for making sections of pine wood. First, sharpen the blade on an oilstone and hone it on a razor hone until it has a razor-sharp edge. Adjust it until it barely cuts a shaving. Clamp a block of pine wood in a vise or hold it in your hand, and plane it until you have a little pile of thin shavings from which to select specimens suitable for mounting. The wood can be stained and mounted in the manner described for stems. Be careful to eliminate air from the cells. One way of doing this is to soak the sections for a few hours in turpentine before transferring them to the balsam.

IN A small stem cut in cross section, you can observe at twenty diameters or so the outer bark, green in places, made of large cells; a layer of fibrous bast cells beneath the bark, and then the cambium layer of living tissue, from whose cells growth progresses. Next are the rings of wood cells, and in the center is a small region of pith cells. In the wood and outer bark you can observe the large, open resin ducts. Radiating from the center like spokes of a wheel, are the medullary rays that act like crosswise (Continued on page 102)

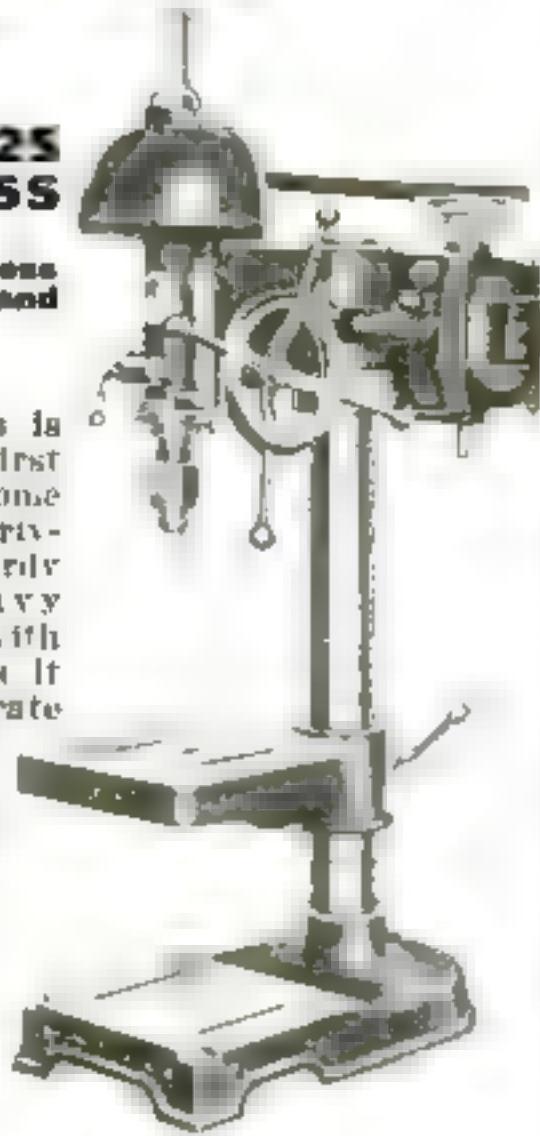
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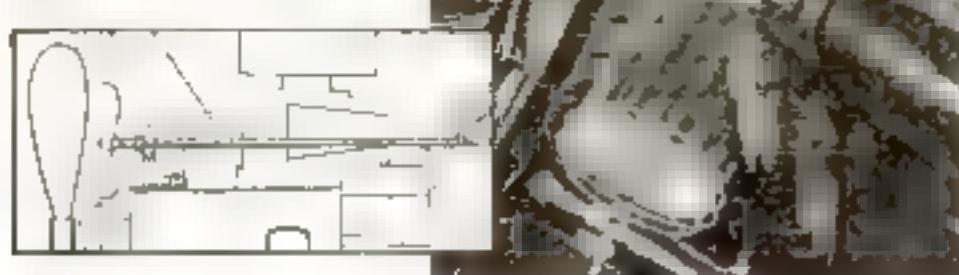
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YOUR CHRISTMAS TREE UNDER THE MICROSCOPE

(Continued from page 101)

city water lines connecting main trunk lines.

The wood of pine trees is composed almost entirely of long, slender tubes, ingeniously grouped together to give strength and to facilitate the life processes of the tree. These tubes, called tracheid cells, react to conditions affecting the tree at the time of its growth. When the weather is cold and the rainfall light, the cells are not able to grow much, if at all, and therefore are small in size. When the weather is warm and there is plenty of rain, the cells grow rapidly and to large sizes.

Therefore you can read, in the cross section of a bit of pine wood, something of the history of the tree from which it came. You find, on examining this section with your microscope, that there are abrupt boundaries between groups of cells. Large cells with thin walls extend in a slightly curved line across the field. Several rows over, the cells begin to become smaller, and their walls thicken; until finally the walls are very thick and the spaces between them barely visible.

THE story told by these cells of different sizes is this: In the spring, the tree has to have lots of food-carrying water coursing through its veins (the tracheids), so that it can grow. The spring rains provide the water, and the spreading of cell material into thin walls provides the necessary space for the water to flow through the tree. As the season advances into summer and approaches autumn, the water supply becomes less, growth slows down, and smaller cells with thicker walls are produced. Finally, as fall progresses into winter, growth becomes still slower, and eventually ceases; and the cells accordingly grow smaller and thicker-walled. Growth is resumed abruptly in the spring. Thus are formed the annular rings, which give wood much of its beauty and enable scientists to tell very closely the ages of trees. Things affecting the formation of cells, such as forest fires or drought years, make their presence known to the wood experts and his microscope.

Running through the groups of cells, roughly at right angles to the annular rings, are streaks of long, slender cells whose sides are visible in cross sections of wood. These are the medullary rays. Here and there among the tracheids you will observe large openings bordered by a few cells of slightly different form. These are the resin ducts that are typical of pine.

When you plane a pine board parallel to the grain, you generally are cutting tangential sections of the ducts. Examination of a thin shaving will reveal more wonders of pine wood. The tracheids, which are not exactly like the cells which botanists call tracheids in deciduous trees, are seen to be not endless tubes, but cells whose ends taper down to a blunt point, and which are fitted together in a most ingenious fashion.

LOOK carefully at the line separating the end of one tracheid from the end of the adjacent one, and you may be able to see the bordered pits, or automatic valves, which regulated the flow of sap from one cell to the next when the wood was alive. If the blade used to cut the section has grazed the end of one of the cells, the pits may be seen as circular formations resembling tiny washers laid side by side.

A radial section of a pine stem is one cut parallel to a line passing through the center of the stem—parallel to the radiating medullary rays. Such a section often will reveal more clearly the bordered pits in the tracheid cells, and also will show, in longitudinal section, the cells forming the medullary rays.

The microscope (Continued on page 103)



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YOUR CHRISTMAS TREE UNDER THE MICROSCOPE

(Continued from page 102)

frequently throws new light upon some important historical fact or condition. This is illustrated beautifully by examining a tangential section of yew wood (Canadian or Japanese yew, or *Taxus*). You will observe that each of the long, slender cells has inside it a spiral, springlike thread. Sometimes these coil-spring structures can be seen more clearly by examining the edge of the specimen, where the cells have been torn in cutting.

Now, it was known to the ancient archers that yew wood is more springy than most woods; and therefore it was used to make bows for shooting arrows. This springy quality, so important to the arrow-shooting hunter or warrior, results from the spiral threads in the cells of the yew. These springs prevent the collapse and breakage of the cells when they are bent, and cause them to return to their former positions. Modern man has taken a lesson from the yew, and employs coil springs to enable him to bend lead pipes without flattening them, and to construct noncollapsible, flexible hose.

WAYS of sectioning, staining, mounting, and otherwise handling botanical materials of the type we have been discussing are almost endless in number. Every professional microscopist has his own pet methods and materials. However, a brief outline of some of the things that can be done may be of help in the preparation of specimens, particularly those for permanent keeping.

Before sectioning leaves, young stems, roots, and other parts which might be crushed by the knife blade, it is necessary to fix or harden them. Simply leaving the specimens in ninety-percent alcohol for a week or so generally is satisfactory. Change the alcohol every day for the first three or four days. Absolute alcohol can be used for very small objects.

A popular general fixing agent is made by mixing seven ounces of one-percent chromic acid, twenty-four drops of glacial acetic acid, and three ounces of distilled water.

Fix the specimen for about twelve hours, then wash it well with water before dehydrating.

After fixing, pieces of roots, leaves, and so on can be preserved in eighty-five percent alcohol, or in a mixture of equal parts of water, glycerin, and alcohol. If the glycerin solution is used, the specimens must be dehydrated before embedding in paraffin.

The number of stains that can be used for darkening cell walls and for bringing out certain details is almost limitless (P.S.M., Apr. '36, p. 44). Staining sections after they have been cut and mounted on the slide is preferred by many botanists to immersing the bulk specimens in the stain.

DEHYDRATION usually is accomplished by passing the specimen successively through alcohols of increasing strength, ending with absolute. Some microscopists have had success with ethylene glycol mono-ethyl ether as a dehydrating agent instead of alcohol. This liquid, which looks like water, is sold commercially as a cleansing solvent for about \$1.30 a gallon. It will dissolve xylol, alcohol, balsam, turpentine, and water. One way of using it in making permanent slides of plant material is as follows: Stain the specimen in any manner desired. Remove it from the stain, put it in the cleaning liquid for thirty seconds, and then transfer to Canada balsam for mounting. To dehydrate fresh-cut material completely, place it in the solvent for a minute or so, stain in an alcoholic solution, transfer to clove oil for clearing, and then mount in balsam. The possibilities of this new solvent have not been thoroughly explored, and further uses for it may be discovered.

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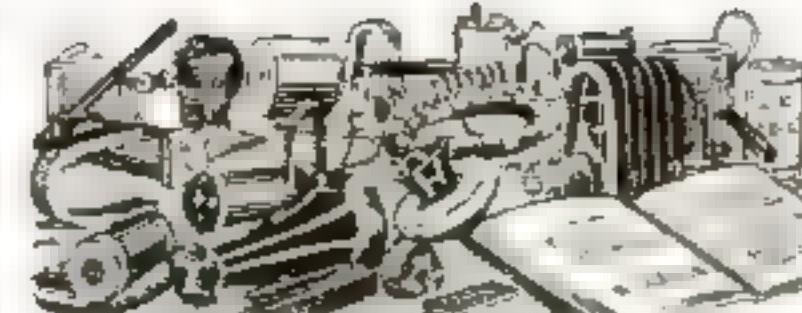
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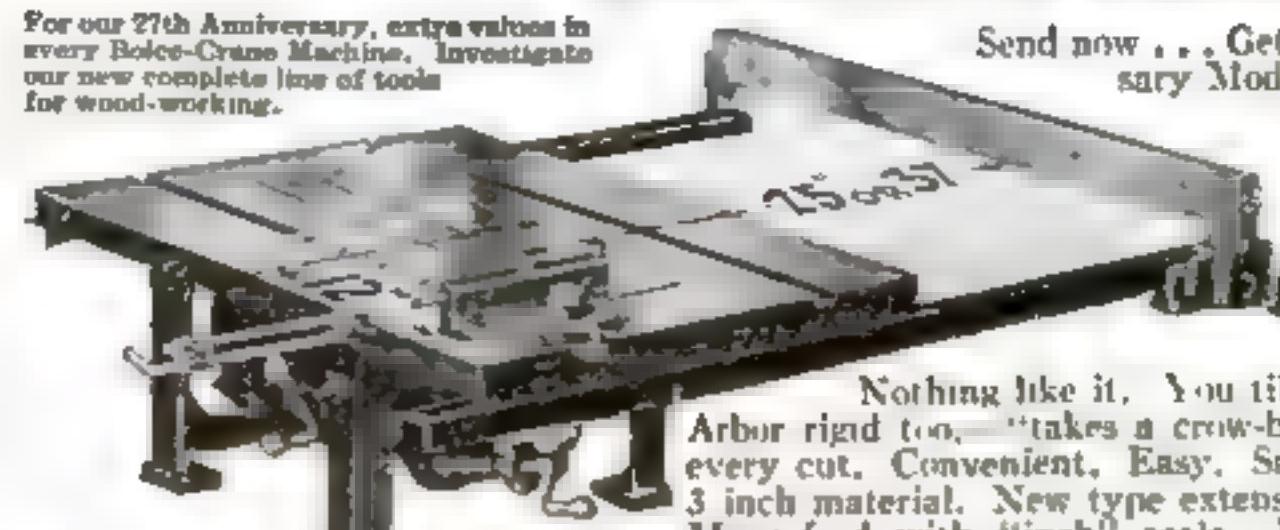
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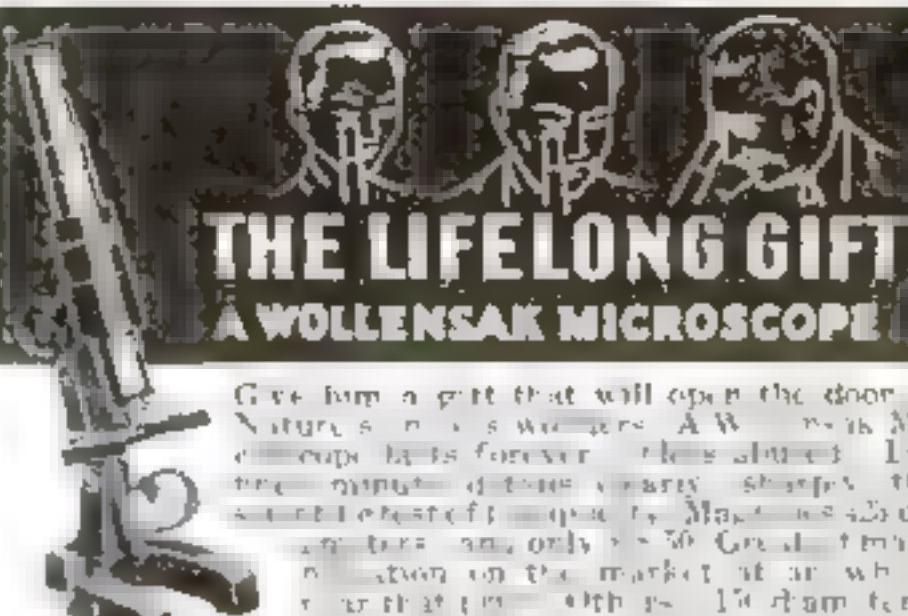
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Armed with my diploma, I went to the — piano factory. This company was turning out about ten pianos a day and had four tuners on the staff. I can remember now how the head of the factory smiled when he asked about my experience and I showed him the diploma. He did however give me a test and the next day I was hired as first tuner . . . the man who gives the final tuning before a piano is shipped out.

I was with the — piano factory for two years and then went to Montreal where I worked in a store for three years. Meanwhile, I kept up with my home studies, learning how to build pianos and much about acoustics.

In 1914 I started my own piano factory in partnership with a friend and after ten years of manufacturing achieved a certain amount of fame out of it. Unfortunately, when the depression came, I had to close my plant as did so many others. Since then I still tune pianos for my own account and today have one of the best repair shops in town.

The study of acoustics also serves me. I have been teaching this subject for the past fifteen years and I am examiner for the piano tuning class in an institution for the blind.

While I am not what you would call a rich man, still I feel that I am well off. I own a city house, a country house, a car, etc. I have raised my son who is a doctor and my daughter is studying at the university. All this I owe to home study.

—O. M., Montreal, Canada.

"OPENED THE DOOR OF OPPORTUNITY FOR ME"

In April, 1934, I was working on a surveying job that had only two more days to run. I had never completed high school but I felt that if ever I was to get out of the rut, it would have to be through study of some kind.

I had written to the — School some time previous for information concerning their courses and the day before my job ended one of the Schools representatives called at my home to give me the information I had requested. Chemistry had always been of deep interest to me although I didn't know the first thing about it. It was my desire to look at a piece of wood or metal, a liquid or any other substance and be able to tell right away the elements of which it was composed. Then, too, I had a real interest in criminology and hoped to see the day when I would have a laboratory of my own where I could handle both commercial and criminal cases.

I enrolled with the — School that night, using practically my last dollar as a down payment. Soon after, I received my first lessons and settled down to the biggest job I ever tackled—Analytical Chemistry.

The course sometimes has been rather difficult but not unfathomable. I am very particular about my work, occasionally spending as much as three weeks or

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a month on a single lesson. This has made me somewhat slow in my progress, but my grades have demonstrated the wisdom of such a policy. I have received the highest marks possible on every lesson but one and on that I was given a "B" because I accidentally omitted one of the questions. All my other grades have been "A's." I am almost through organic chemistry now and will soon be doing the analytical work required in the course.

Due to what I had already learned, I received a minor appointment in a laboratory here analysing fish oils. I have had this appointment for several months now and although the job is merely a start for me, still it is an opening to better things. The fish industry (reduction) is new here, having been started only last season. But this year there are several more plants being built and it promises to become one of our leading industries.

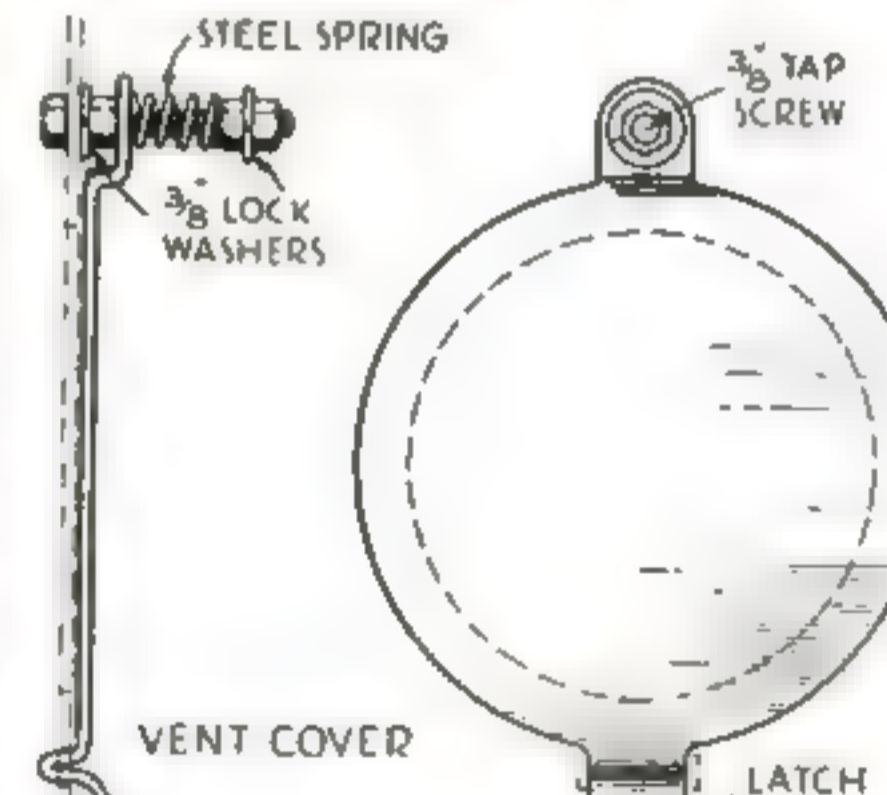
Therefore, I believe I am getting in on the ground floor of something that has many possibilities. I can truthfully say that without the training I have received from the — School, this door of opportunity would have remained forever closed as far as I would have been concerned.

I heartily endorse home study to all who find the lack of training to be the reason for their failure to advance in their work.

—W. B. J., Marshfield, Oregon.

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The sheet-metal cover is cut as shown in the front view, and mounted as in the edge view

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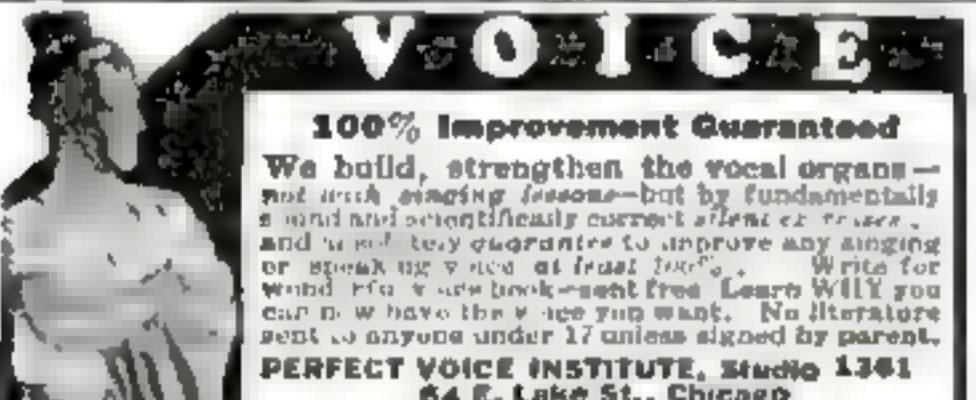
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NEW FIGHTING SHIPS CHANGE NAVAL WARFARE

(Continued from page 13)

and triple bottoms guard the hull against torpedoes and mines.

No longer is a battleship sufficiently protected from gunfire by concentrating most of its armor in a vertical belt along the sides. The German shells that sent the British battle cruisers *Indefatigable* and *Queen Mary* to the bottom in the Battle of Jutland did not strike the armor belt, but pierced the deck. When naval combats were fought at close range, a thin horizontal plating of armor was sufficient to withstand shells that glanced off the decks; today, with targets up to seventeen miles away, shells may drop from the skies at angles of thirty to fifty degrees. Hence, the latest battleships provide heavy horizontal as well as vertical armor, forming a caisson around such vital parts as ammunition magazines, boilers, turbines, and posts of command.

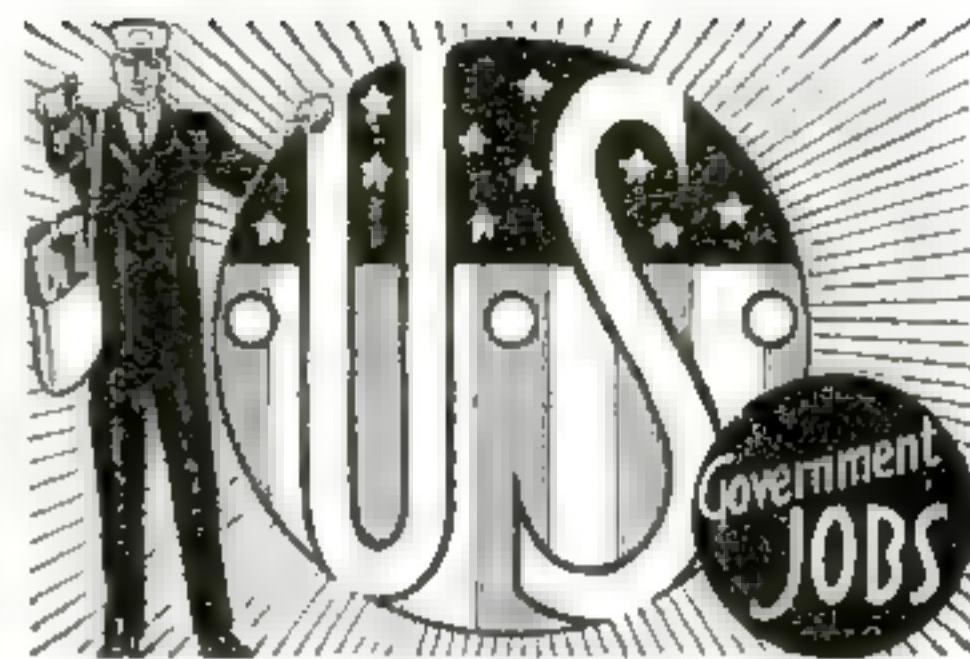
GUN turrets, too, come in for heavy protection—for these highly mechanized factories of death, exposed as they necessarily must be, contain the battleship's whole fighting power and must be safeguarded at all costs.

Germany's 26,000-ton battleship *Scharnhorst*, launched just the other day, reflects the lessons naval designers have learned. To an armor belt reaching a maximum of twelve inches in thickness, it adds a pair of horizontal decks of five-inch and two-inch thickness, one above the other, to prevent shells and air bombs from penetrating. Fourteen-inch armor covers the fronts of its turrets. France's new 26,000-ton *Dunkerque* also supplements its armor belt with double-armored decks, and staggers under a total weight of "passive armament" amounting to forty percent of the whole weight of the ship!

Ordnance designers have met the armor makers' challenge with shells that will pierce twelve-inch armor at more than nine miles range! The implications are staggering. Today, the ponderous armor of the world's biggest ship of the line, the 42,100-ton British battle cruiser *Hood*, cannot be considered invulnerable to the eleven-inch shells that even the "pocket battleship" *Deutschland* can hurl against it—though it is true that one of the *Hood's* fifteen-inch projectiles would probably "liquidate" the *Deutschland*.

Have the gun makers won the contest, then? Not entirely. For armor, even if pierced, still helps protect a ship. Only a thick-walled shell, which can carry less explosive and therefore do less damage than a thin-walled projectile, will smash through. Its progress is checked, and it bursts before reaching the innermost parts of the vessel. Moreover, the breach in an armored hull is no larger than the shell's cross section, while a gap of a square yard or two may be torn in an unarmored hull—an important difference if the hit is just below the water line, where the sea rushes in through the hole.

UNITL now, America has been a side-line spectator of modern ideas in battleships. Today, the whole world is building them. Germany's *Scharnhorst* is to be followed by its twin, the *Gneisenau*; France's *Dunkerque*, by its sister ship *Strasbourg* and two 35,000-ton battleships, the *France* and *Patrie*. Italy has a pair of 35,000-ton battleships under construction, the *Littorio* and *Vittorio Veneto*, that it boasts will outclass anything so far afloat in their combination of armament and fleetness; they will mount nine fifteen-inch guns apiece and are designed for the remarkable speed of thirty-four knots. Now, England and Japan plan first-class ships expected to be the most powerful of all—and America will follow suit, maintaining her traditional policy of a navy second to none.



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BILLBOARDS OF FLAME

(Continued from page 21)

spectaculars advertised ginger ale, chewing gum, and beer. The first showed grinning Eskimos pulling a sled in front of a brilliant aurora borealis. The second had peacocks with sixty-foot tails, and a fountain that sent a spray of colored lights thirty-four feet into the air. A gigantic eagle that flapped its wings high over Broadway was the central attraction in the beer advertisement.

When the King of Siam visited the United States, before the World War, he was so captivated by the flapping eagle that he wanted one to take home with him. So, the outdoor-advertising company which had created the display produced a duplicate of it for the amazement of citizens in Bangkok, the far-away capital of Siam.

EVEN more spectacular than any of these was a gigantic representation of a Roman chariot race which appeared on Broadway about twenty-five years ago. In shifting lights, it showed the cheering crowds, the jeweled trappings, the horses and chariots in a great arena. To produce the effect, 2,500 flashes of electricity a minute had to reach the huge display.

Other cities, as well as New York, have their historic signs. In San Francisco, a towering, animated display advertising paint has been a landmark for years. At Chicago, Ill., it is a sign extolling the virtues of a cleanser; in Atlantic City, N. J., it is a tribute to a brand of cigarettes; at Dallas, Tex., it is a gasoline advertisement. So prominent are some of these signs that they receive "fan mail" of their own. I was told of several cases in which people have written to express appreciation for the free show.

In the lingo of outdoor-advertising men, there are two kinds of electric signs: dealer signs and spectacles. The first are erected at points of sale, over stores and service stations; the second, bigger and animated, provide spectacles that create good will and impress the name of a product upon the public.

To tell how many people see a given sign in one day, elaborate tests frequently are made. A special organization, known as the Traffic Audit Bureau, stations men at strategic points to count the passers-by. During certain hours of the morning, afternoon, and evening, they keep records which give a key to the total number of persons passing the spot in a day.

The biggest crowds are concentrated in Times Square, the district extending from Forty-second Street to Forty-seventh Street, at the intersection of Broadway and Seventh Avenue, in New York City. According to the figures of the Transit Commission, approximately 1,100,000 persons pass through the area in a single day. Ranking next to Times Square as a location for spectacles is the lake front at Chicago. Third-best site in the United States is the Boardwalk at Atlantic city.

TO PROTECT the millions of pedestrians who pass beneath these heavy signs, cities have established strict regulations for their construction and design. In New York, the signs must be twice as strong as seems necessary in order to meet emergency strains. All wiring must be inclosed in pipes to prevent fire in case of a short circuit. To enable firemen to get under and around the signs if the building catches fire, the spectacles must be placed six feet back from the fronts of the buildings and must have an open space seven feet high under them.

A problem that the city ordinances didn't cover, popped up a couple of years ago. Every time a new sign flashed on, radios in the vicinity gave out the grating sound of static. An interference eliminator had to be installed

before the condition finally was rectified.

Walking up and down Broadway, night after night, a corps of men does nothing but watch the spinning, swinging, flashing lights of the spectacles. They are employees of the Broadway Maintenance Corporation, an organization that spots and replaces burned-out bulbs in the big displays. The bulbs used in these signs last from two months to a year. Every night, some go dead; unless they are replaced, the sign develops "smallpox," that is, becomes speckled with black spots that destroy its effectiveness. High above the crowds, the caretakers dangle on boatswains' chairs to remove old bulbs and screw new ones in their place. Winter and summer, storm and rain, find them at their risky work.

Every morning, a report of the number of bulbs replaced during the night, as well as the exact time the big sign went on and off, goes to the advertiser who is footing the bill. If a storm, fire, or accident cuts off the electricity and the display is darkened, the advertiser is credited with that much time and his bill is adjusted accordingly.

SINCE 1920, neon tubes have been given a larger and larger part in the lighting of spectacles. Today, bulbs and tubes run about fifty-fifty on the larger signs. The new peanut display, for instance, has ten layers of neon tubes, one above the other, to produce some of the action. Neon tubes, as you probably know, are not all filled with neon gas. Some contain xenon, others krypton, others helium, and still others argon. Five colors are now available: red, white, gold, green, and blue.

In Chicago, as dusk falls over the lake front each day, Fred Bunnel, "captain" of the biggest sign in the city, enters a little elevator and rises to a tiny office high among the girders of the giant display. Here he presides over the battery of automatic mechanisms which operate the spectacular. At two in the morning, his "day's" work is ended. An important part of his job is watching over the motograph. Operated by perforated rolls of paper, like those of a player piano, it flashes a continuous, running message along a narrow strip of the sign.

Probably the largest motograph in the country is that which circles a building in Times Square and gives the latest news of the world. Its original cost was \$120,000. It has 14,800 lights and needs two experts to operate it. Nearly eighty of these electric newspapers are now in operation in various parts of the world.

NEW ideas have recently added to the realism of many spectacles. The most ingenious sign on Broadway, and the one that attracts a hon's share of attention, shows a gigantic cup of coffee, outlined in neon tubes, with real steam rising above it. The steam is piped 200 feet in the air from street level. On the way, its pressure is reduced from 140 pounds to one pound to the square inch. Thus, when it reaches the perforated pipe at the top, it drifts lazily upward in realistic fashion.

New Yorkers have noticed that this sign acts as a weather barometer. Approaching rain seems to make the steam billows larger; in dry weather they appear to shrink in size.

Douglas Leigh, the young Alabaman who originated the sign, told me he believes the future of these big displays lies in the direction of combining lights with various effects. The spectacles of tomorrow may utilize steam, smoke, sparks, and even running water, in addition to varicolored bulbs and neon tubes to achieve their ends. Beyond that, Leigh sees the ultimate goal: televised images flashed on giant sign areas to provide free shows as well as advertising.

FILLING UNCLE SAM'S MARKET BASKET

(Continued from page 35)

traps, baseball masks, photographic negative preservers, wrenches of many sizes, American flags, all are ranged in order on the shelves and hangers of the sample room.

When deliveries reach the Warehouse, further tests are made. First, the shipment is isolated to prevent its becoming mixed with accepted goods. Then it is checked with the order to be sure the quantity is correct. At this point, inspection experts go into action. Selecting samples at random, they either test them on the spot or send them to the Bureau of Standards, the Department of Agriculture laboratories, or some other specialized point of research. Foods are examined by the Department of Agriculture scientists. Each year, the Procurement Division buys \$100,000 worth of foodstuffs for distribution in Washington alone.

EARLY experiences with "chiseling" manufacturers have taught the inspectors to be wary. There was one case in which a barrel labeled "Macaroni" was found to contain floor sweepings with a thin layer of macaroni at the top. There was another instance in which a shipment of typewriter ribbons was rejected as below standard. The maker stored them in a local warehouse for ten days, and submitted them again as new ribbons. In such cases, the offending firm is stricken from the list of eligible bidders.

Most difficulties, however, arise from misunderstandings, mistakes, or accidents. A few days ago, for example, an inspector opened a bale of supposedly sterilized cloths and found in the middle a blackened tobacco pipe. Some workman had dropped it into the bale by accident. The whole shipment was rejected.

Occasionally, the mystifying behavior of a product will puzzle inspection men for weeks at a time. A short while ago, a large shipment of flour arrived from a southern mill. Tests showed that it was fully up to specifications. Yet, a few weeks later, complaints began pouring in. The bags of flour were full of weevils! Where had they come from? Not one of the insects had been encountered in the samples picked at random on receipt of the bags. It was a Department of Agriculture man who solved the mystery. He found that the flour contained minute weevil eggs. Lying on the warm floor of the warehouse, the bags had acted as incubators, hatching out the insects!

Another complication of the sort is the prize story at the warehouse. Twelve thousand cans of cooked apples came in, a few years ago, and samples were tested at a Department of Agriculture laboratory. The scientists gave the cans a clean bill of health, and thousands were shipped out to various hospitals and penal institutions. It wasn't long before the cans were heard from. Reports came in that they were acting mysteriously—bulging as though about to explode!

SAMPLES were returned to the warehouse and rushed to the Department of Agriculture laboratory once more. A few minutes' examination showed the cause of the trouble. In canning, a tiny amount of yeast is sometimes added to cooked apples. In this instance, too much had been used. The cans that were opened at once were all right, but those that sat on the shelves began to bulge and swell as the yeast got in its work.

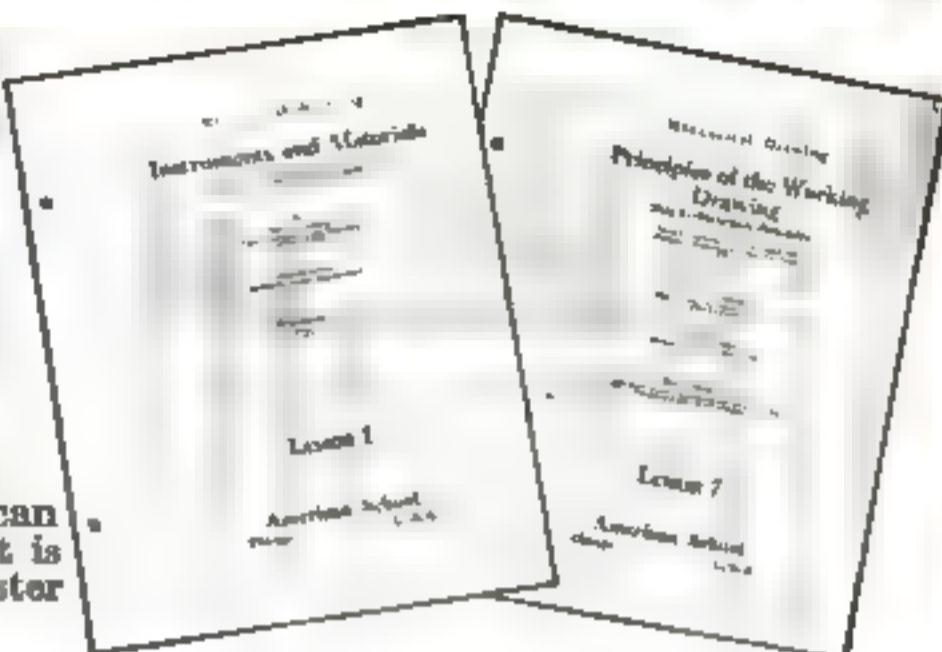
Year after year, the Procurement Division saves taxpayers millions of dollars. Yet, curiously enough, the average citizen hears about only one of its countless purchases. Every year, I was told, newspapers run a story about the fact that the Division supplies the Government with red tape. Last year, it bought 200 rolls for tying up old documents.

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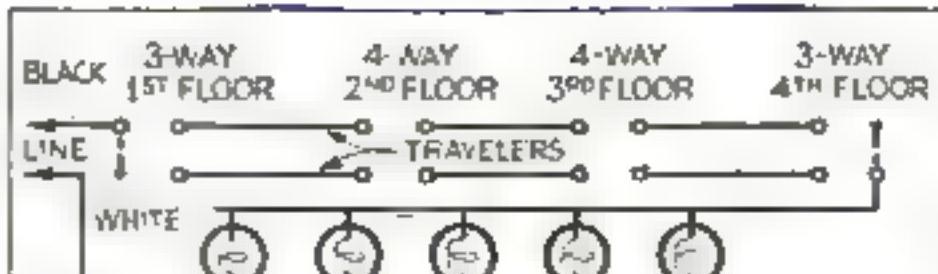
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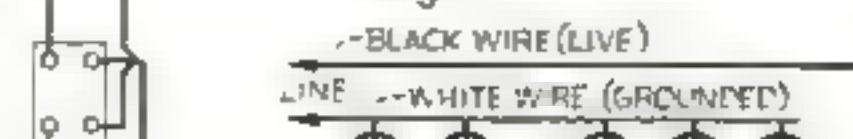
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CONNECTING SWITCHES

(Continued from page 73)



FIVE LAMPS CONTROLLED BY SWITCHES ON FOUR FLOORS
Fig. 5



SOME 4-WAY SWITCHES CONNECT AS ABOVE BUT MODERN TYPES ARE AS IN FIG. 5

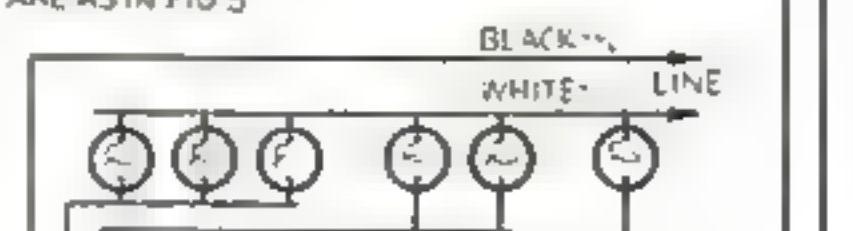


Fig. 6 5-LIGHT FIXTURE

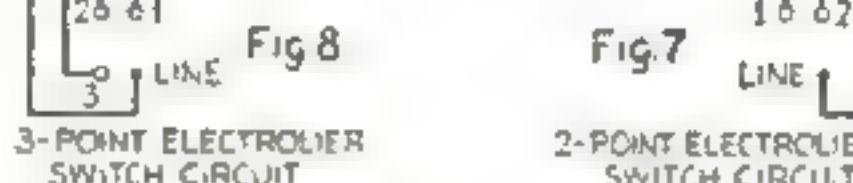


Fig. 7 3-POINT ELECTROLIER SWITCH CIRCUIT



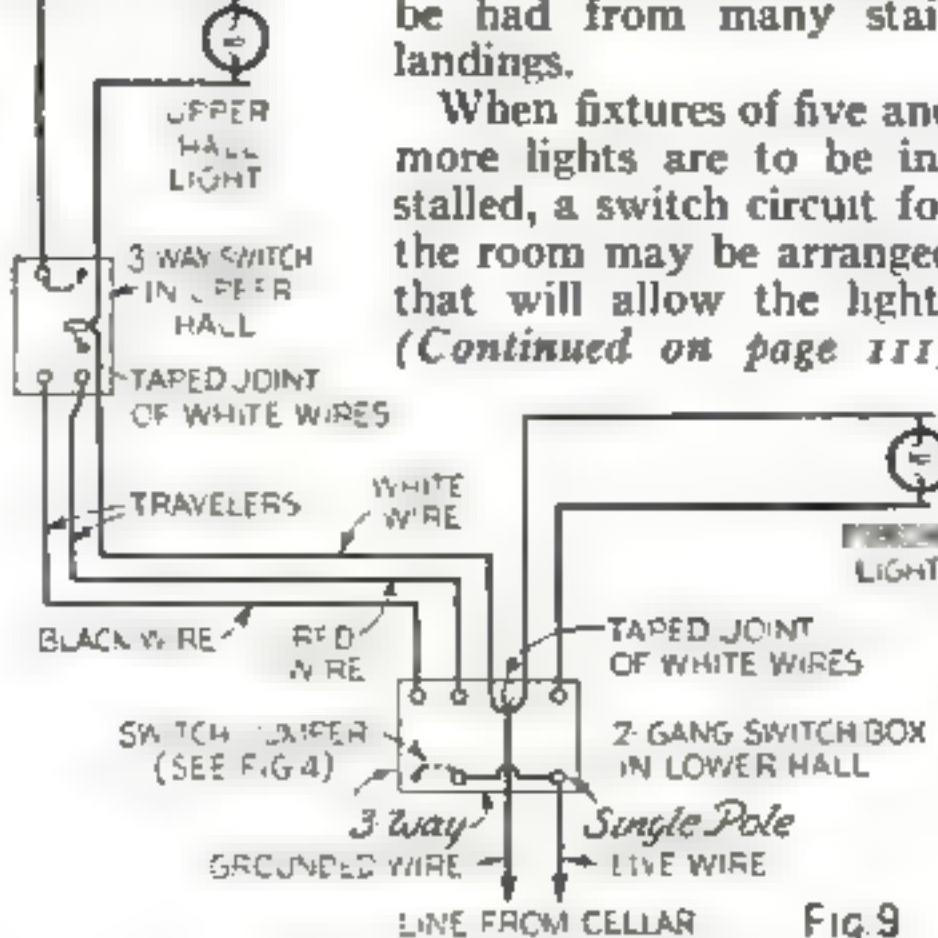
Fig. 8 2-POINT ELECTROLIER SWITCH CIRCUIT

shows where to connect the wires. It will be noted that in the position drawn the top right terminal of the switch is jumped across to the lower right terminal with a metal jumper inside the switch. Either of these posts may be used to connect the light or line wire, as the case may be, but the unused one is left vacant. The two left-hand terminal screws are used for the connection of the traveler wires. The three-way circuits show that two wires connect the two switches together. These wires run parallel to each other and are called travelers because it is over first one and then the other that the current flows as the switches are operated.

It will be noticed that one line wire is marked "black" and the other "white" in the first diagram of Fig. 4. That is because the white wire is the grounded one in modern polarized systems, and the Underwriters require that this wire shall be connected to the outside or shell terminal of every socket. This terminal is the silver-coated screw in the socket. The black or live wire is the one that all switching is done with, so that with the switch "off" all wiring to the fixture will be dead. This is important and should be closely adhered to.

If it is desired to switch lights from more than two locations, we have the four-way circuit shown in Fig. 5. This is nothing more than a three-way circuit with as many four-way switches cut in the traveler wires as necessary. With an arrangement of this kind, control of hall lighting can be had from many stair landings.

When fixtures of five and more lights are to be installed, a switch circuit for the room may be arranged that will allow the lights (Continued on page III)



A typical hall and porch-light arrangement and, at top of page, other switching methods

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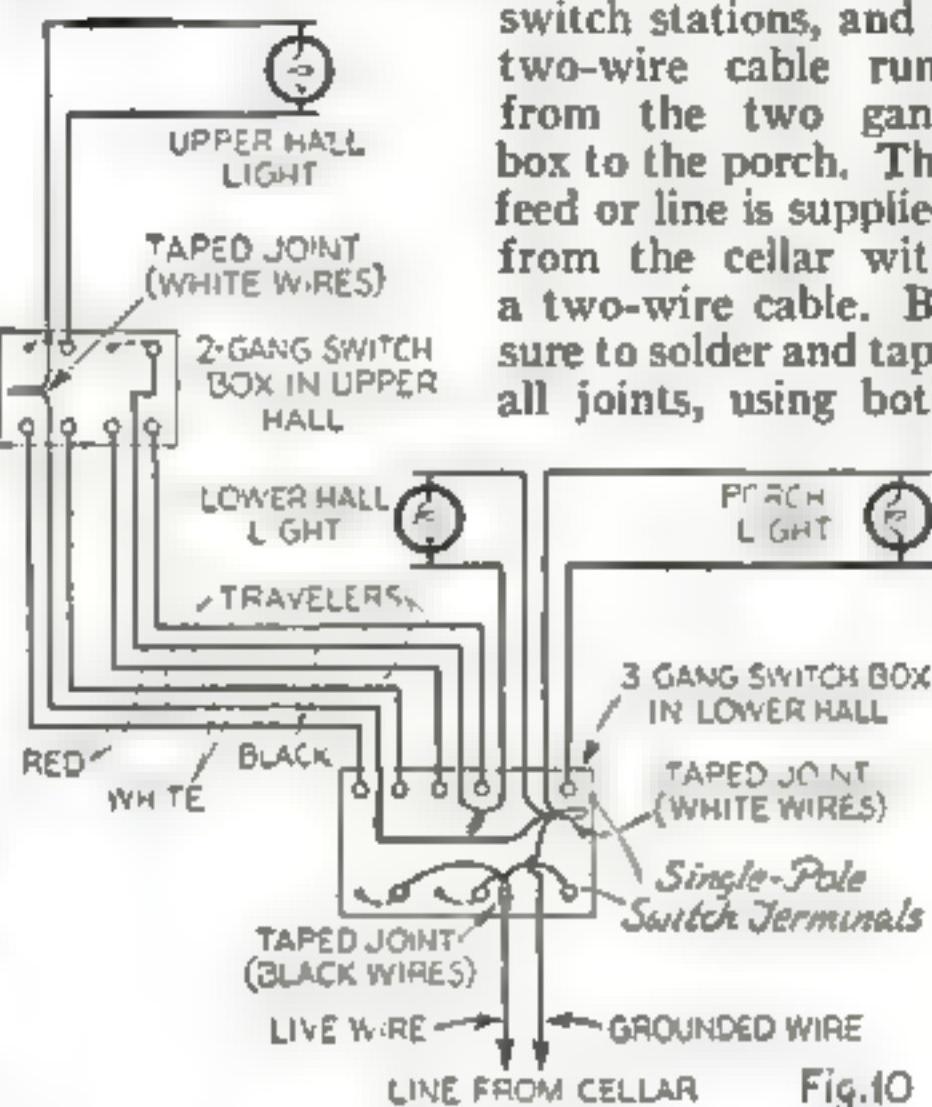
CONNECTING SWITCHES

(Continued from page 110)

to be controlled in separate groups rather than all at once. Referring to Fig. 7, the grounded conductor connects to one side of all lamps. The live wire runs to the switch, and there are two wires between the switch and lamps. In wiring, a two-wire BX feed should be used into the light outlet and a three-wire BX cable from the outlet to the switch. Two, three, or five lamps may be controlled.

A still finer division of the cluster of lamps is possible with the three-point electrolier circuit shown in Fig. 8. This circuit is similar to the other, but it has one more wire running between the lamps and the switch.

To take an actual example, in Fig. 9 there is a light in the upper hall controlled by two three-way switches, one on the porch controlled by a single-pole switch, with the lower three-way and porch switches grouped in the lower hall in a two-gang box. A piece of two-wire BX runs from the hall outlet to the upper switch box. Three-wire BX connects the switch stations, and a two-wire cable runs from the two gang box to the porch. The feed or line is supplied from the cellar with a two-wire cable. Be sure to solder and tape all joints, using both



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Another case, Fig. 10, requires the addition to the preceding circuit of a light in the lower hall controlled by another set of three-way switches. This gives ideal hall lighting. A three-gang switch box is installed in the lower hall, and a two-gang in the upper hall. Two three-wire BX cables connect the two switch stations, and two-wire cables run to the other outlets as shown.

In connecting switches, bear in mind that the white line wire must always go direct to one side (silver screw terminal) of each light. It helps avoid confusion to make these splices first. The black or live line wire always connects to one side of the switches. The connecting wires that run between the other side of the switches and the brass screw terminals of the lamps, convey the live side of the circuit to the lamps, thus completing the runs.

In using three-wire cable for three-way switch wiring, it is a good plan to use the black and red wires for the travelers and the white wire for the grounded conductor where that side is being run to the light, as in the upper hall light of Fig. 10. The lower hall light is getting its grounded conductor supply from the taped group of white wires in the three-gang box. We could use any two colors for the travelers, it being common practice, however, where the white wire is not required (as in the upper hall feed) for a ground conductor, to use the black and white wires for the travelers and the red wire for the connection to the light.

As a final bit of advice, be sure you have all wiring work inspected by your local authorities to avoid fire and insurance trouble.



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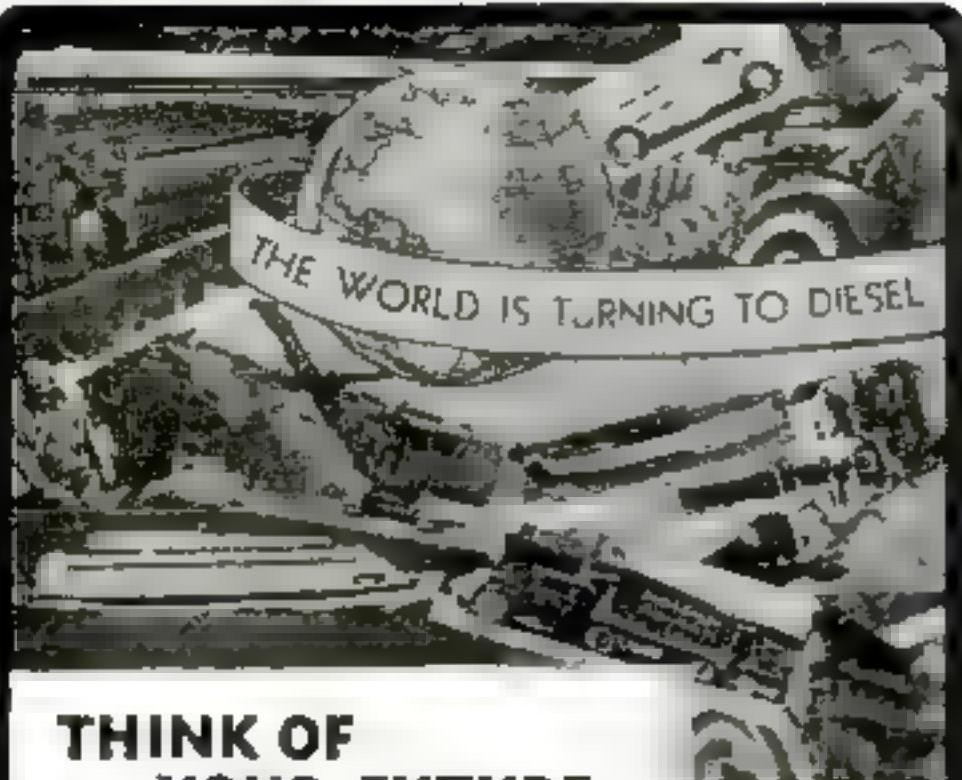
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RIDING HERD ON SEALS

(Continued from page 23)

far to the south. The bulls usually winter off the southern coast of Alaska.

Immediately, each bull tries to collect the largest possible harem. A single male may have as many as 100 wives. The average on the islands is forty. As each female comes ashore, a bull picks her up by the back of the neck, like a kitten, and carries her to the few square yards of beach he defends as his own. Almost as soon as the females come ashore, the young seals are born. Each female has a single offspring, big-eyed and black. Later in the summer, its coat turns to the sleek, brown hue of its mother's. Although the males are called bulls and the females cows, the young seals are referred to as pups—and the congregating spots on the beach are known as rookeries!

DURING the next six weeks or more, the bulls neither eat nor sleep. They spend night and day guarding and taking care of their harems. If a wife tries to escape, the bull grasps her by the back of the neck and flings her over his shoulder onto the rocks behind him. The big excitement comes, however, when one beach sultan tries to raid another's harem.

With a hissing roar, the outraged husband charges the interloper. Oftentimes, it is a battle to the death, with the victorious warrior hurling his rival's body into the adjoining harem; the master of that area rushes at it and tosses it on to the next bull, and the process is repeated until the slashed and battered body of the defeated male lies discarded on the rocks. In a single season, a warrior bull may fight a hundred desperate battles in defense of his harem.

By the end of the breeding season, the males, instead of being sleek and fat as they were when they arrived at the islands, are mere skin and bones. They are covered with wounds from head to foot; their flippers are bitten and ripped; their little, two-inch ears and tails are often in shreds. Slipping into the water, they swim off by themselves to spend the winter resting up for the next breeding season.

Bulls are good for about six years of this intense activity. Later, the old and weakened males, the has-beens of the herd, congregate by themselves on sandy stretches of the shore. Other seals avoid sand because it gets in their fur and bothers them; they pick out pebbly or rocky spots when they clamber from the surf. The black rocks of the Pribilofs have been polished smooth by the slithering bodies of millions of seals.

CURIOSLY enough, the baby seals are afraid of the water. They have to learn to swim just as humans do. When full-grown, however, they are so completely aquatic that they sleep stretched out on the rolling surface of the sea and spend months out of sight of land. A baby seal never recognizes its mother, but the cow will nose among thousands of pups clustered together in "pods" until she finds her own. As seals nurse only their own babies, pups starve to death if anything happens to their mothers while away on hunting expeditions which sometimes carry them a hundred miles from the islands. Thus, in the days of "pelagic" sealing, or killing the animals at sea, every female shot meant two seals gone, because the pup left motherless on the islands died too.

As soon as the youngsters learn to swim, they demonstrate all the playfulness of kittens, diving for shells and tossing them in the air, racing across lagoons, and playing tag in the surf. Occasionally, a blundering whale approaches the islands and the seals flock out in scores to dive under and leap over the monster. Oftentimes, when a Coast Guard

ship anchors offshore in darkness and plays its searchlights on the water, the seals frolic and leap in the illuminated waves. And, when landing parties row ashore, the playful animals approach without fear and jump over the oars of the boats.

Queerest of the customs at the islands is the treatment of the young males. The bulls are three years old before they begin to gather harems of their own. Before that time, they keep to themselves, playing in the water or romping on level parade grounds back of the rookeries. Narrow lanes are left between the harems, along which the young males can travel from the water to the parade ground. The jealous beach sultans ignore them, as long as they keep to the lanes between the thousands of females.

Only the two-year-old males are killed for fur by the Government. To determine how many surplus males there are, the officials on the islands make an annual census, photographing the rookeries from identical vantage points each year. Rocks bearing symbols in white paint are easily distinguished in the pictures and aid in estimating the number of animals in the different rookeries.

When it has been determined how many of the two-year-old bulls can be sacrificed without injuring the herds, preparations are made for the strange annual execution. It is called "walking out the bulls." The start is at midnight, with natives driving the animals slowly over the damp grass in the direction of a great open space strewn with the bleaching bones of countless seals. There are frequent stops for rest. If the animals become overheated, the fur is spoiled.

On arrival at the slaughtering ground, the natives set to work. They are divided into four groups—clubbers, stickers, rippers, and skinners. The clubbers stun the seals with heavy bludgeons; the stickers drive long knives into the hearts of the unconscious animals to insure their death; the rippers cut around the necks and flippers, and the skinners remove the pelts. Members of each group are trained for their work from childhood. So expert are the skinners, for example, that they can strip a pelt from a large seal in fifty seconds, although it must be cut from the carcass all the way around. The flippers, under the skin, have ridges like fingers. Frequently, when a Skinner's knife becomes dull, he will sharpen it by stropping it on a flipper.

One concern, the Fouke Fur Company, of St. Louis, Mo., supervises the killing of the seals, the shipping and tanning of the pelts, and the auctioning off of the furs. Packed in salt, the skins travel nearly 4,000 miles to a two-story brick building in St. Louis where workmen tumble them about in revolving drums, knead and rub them, treat them with maple-wood sawdust and, finally, clip and dye the furs in preparation for the market. When the treating is over, the pelts are so soft that you can pull one through a circle made with your thumb and forefinger.

Special vegetable dyes, perfected by the Fouke company, give the treated seal skins their different shades of color.

Twice a year, in April and September, the furs are auctioned off in a flag-draped room in downtown St. Louis. They are sold in lots of seventy to buyers who come from New York, London, Paris, and other fur centers of the world. Last year, the profit to the U. S. Government, after the commission due the Fouke company had been paid, amounted to nearly a million dollars.

So, it is no wonder that, a few months hence, Coast Guard cutters will put out from San Diego, Calif., Seattle, Wash., and other points along the 3,000-mile route of the returning seals, to protect these valuable herds on their long trip to the Pribilofs.

SNAKES ARE HIS FRIENDS

(Continued from page 41)

hook underneath the body about one third the distance back from the head, lifting the snake, and dropping it into a sack. Even the most vicious never attempt to strike him while they are suspended on the hook, because they are exerting all their energies in an effort to avoid falling.

When on expeditions within the United States, Perkins ships snakes to the zoo whenever he has a sufficient number to warrant boxing them. At night, he usually keeps them in boxes in his tent. Sometimes, particularly in midsummer, he must find some means to cool them.

ON A recent trip into Borego Valley, a small offshoot of California's torrid Imperial Valley, he caught snakes in the late afternoon and tried to keep them alive in a temperature which hovered around 115 degrees, by swathing them in moist cloths. After twenty big red rattlers had succumbed to the heat, he devised a scheme for lowering his catches into a dry, cool well. In this way he kept alive a number of rattlers, shovelnoses, and leafnoses until he could escape the heat for cooler air on the coast. "It was so hot during this trip," he commented, "that lizards would run from bush to bush, then lift their heels from the sand in an effort to cool them—believe it or not."

In order to preserve snakes in transit, Perkins devised a "safe and sane" method for shipping them. He first places several in a sack eighteen inches wide and thirty-six inches long, and ties the mouth closed. Sacks tied, he lowers them carefully into an excelsior-lined orange box, and nails and straps the box closed. The open slats provide plenty of air, the excelsior cushions the snakes against bumps, and the light weight saves freight.

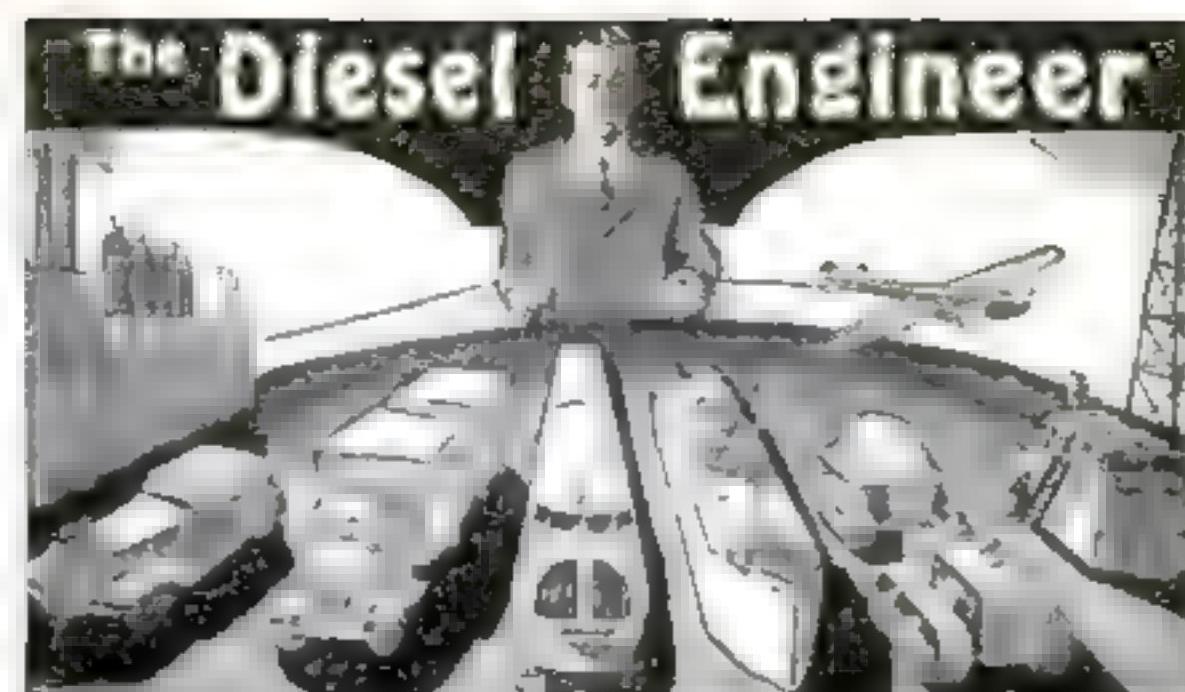
Only once, in the hundreds of shipments he has made, has he had an escape. On that occasion, he sent twenty-six new-born garter snakes in a single sack from Colorado to California. Instead of tying the sack closed, however, he ran the end under a sewing-machine needle. But the bobbin apparently had run out of thread, and soon after the train began to move the tiny creatures started crawling. Garter snakes were scattered along the right of way from Denver to San Diego, one being captured in a San Diego back yard eight months after the empty sack was opened in Perkins's office.

BY HIS own actions, this man has debunked many of the thrill stories told of dangers in capturing reptiles. While walking down a leaf-covered path in southern Mexico, he saw a ten-foot boa crawling aimlessly from one side to the other. Finding a short stick nearby, he pressed the stick down on the serpent's head, picked him up, and stuffed him into a sack. The great snake made no effort to bite him.

"In fact," he told me, "you will never be bitten by a nonpoisonous snake unless you are trying to catch it. Rattlers will strike, seemingly without provocation, as you walk through the hills or on the desert. Possibly poisonous snakes realize that a single bite will vanquish a man, while the nonpoisonous varieties know they must hang on, twisting and writhing and tearing, to accomplish any real harm."

"I have caught many harmless snakes, particularly in the western United States and in Java. Some submit quietly, others continue to fight back after years in captivity. Oddly, too, one will bite, while another of the same species becomes quite friendly. Like humans, I guess."

On his recent trip to Borneo, the Celebes Islands, Java, and India, he took three kinds of pythons, as well (Continued on page 114)



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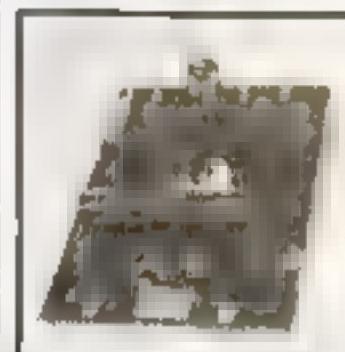
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SNAKES ARE HIS FRIENDS

(Continued from page 113)

as seven of the eight known deadly species in Java. His largest was a twenty-six-foot python. The python submitted easily, ate well in the Orient and aboard ship, but died the day it reached North American shores.

In the Dutch East Indies, he found, the natives are quite expert in catching snakes, but are not above deceiving a purchaser. At Surabaya, in Java, he encountered a native whose long name he contracted to Nikko. Each morning at seven, Nikko would come to Perkins's tent with one or two snakes. Each morning he offered a krait, which closely resembles a cobra, and each morning Perkins repeated his demand that Nikko bring him a cobra.

"One guilder for any cobra," he told the little brown-skinned man. "Two guilders for any new snake."

"Me understand, boss," the native would reply, and next day he would deliver another krait.

FINALLY, Perkins took matters in his own hands and set out in quest of cobras. Near his camp, he came upon a fine specimen, not a cobra, and, after burrowing under a fallen palm tree, pulled out from among the bamboo shoots the deadly doliophis already mentioned. Rare among collections, this snake has a body two feet long, but its abbreviated tail measures scarcely a half inch. Its poison glands extend from the fangs one third the length of the body. Despite its poisonous nature, its black, red, and white stripes make it a rarely beautiful creature.

The cobra came later, bought for two guilders (\$1.40 in American money) through the efforts of another native.

Venomous reptiles of foreign lands have nothing on our own poisonous snakes, though. Perkins matches the western diamond-back and prairie rattlers against all comers. These two species are the most vicious he ever has encountered in the field, surpassing in toxicity and amount of poison even the eastern diamond-backs found in the southeastern United States. The prairie rattlers calm down in a day or two, but the western diamond-backs, being more nervous, remain ornery until death.

Most of the reptiles he has captured are, in his words, "mere babes." Now he wants to journey up the Amazon in quest of anacondas; onto the Galapagos Islands in the Pacific for huge rattlers reported there; to Australia for the poisonous brown-banded tiger snakes and blacksnakes. He has no fear of any reptile, for he has learned that, with a little care, he can capture the biggest or the most vicious snake in existence with relatively little danger. Yet, nearly every week, he is bitten by one of his "pets." Even in the matter of being bitten, he has developed a technique which saves his hands and arms from severe lacerations.

WHEN approaching nonpoisonous snakes in trees, he often suffers bites which gloves would prevent. By holding his arm still, however, he allows the fangs to penetrate and be withdrawn, leaving only pin pricks as temporary scars. Only the day before I visited him the big python had clamped down on his right forearm.

"Have you ever been struck by a poisonous snake?" I asked.

"Not for publication," he declared. "I'm ashamed of those instances, for a little more care would have prevented them. But, speaking of poisonous fellows, I've heard that rattlers swarm down the hills below Prescott, Ariz., by the millions. Some day I'm going over, and I hope that when I get there I will find that there are so many I'll have to stop the car to let them go by."

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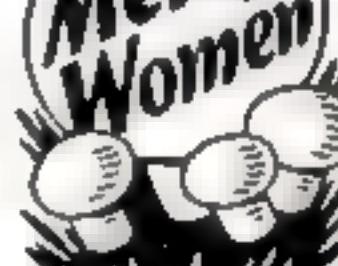


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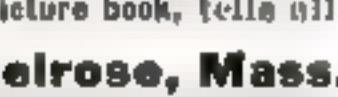
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HOME-LABORATORY TESTS OF HYDROGEN SULPHIDE

(Continued from page 55)

precipitate of antimony sulphide. Led into a solution of copper sulphate, the gas throws down a black precipitate of copper sulphide. You will find it interesting to try the same experiment, and observe the colors produced, using solutions of salts of mercury, bismuth, tin, arsenic, lead, cadmium, manganese, nickel, and cobalt.

With a few spoonfuls of animal charcoal and a solution of lead nitrate, you can perform a pretty little experiment in adsorption, using hydrogen sulphide as a detective agent. Dissolve a quarter gram of lead nitrate crystals—about as much as will rest on the pointed tip of a knife blade—in 100 cubic centimeters, or roughly half a tumblerful, of water. Place the charcoal in a folded filter paper, resting in a funnel, and filter the lead nitrate solution through it. The charcoal has the curious power of removing, or "adsorbing," the lead nitrate that was dissolved in the water. To prove this, pass hydrogen sulphide gas through the filtrate. No precipitate is formed. But if you treat an unfiltered solution of lead nitrate with hydrogen sulphide, you get a black precipitate of lead sulphide.

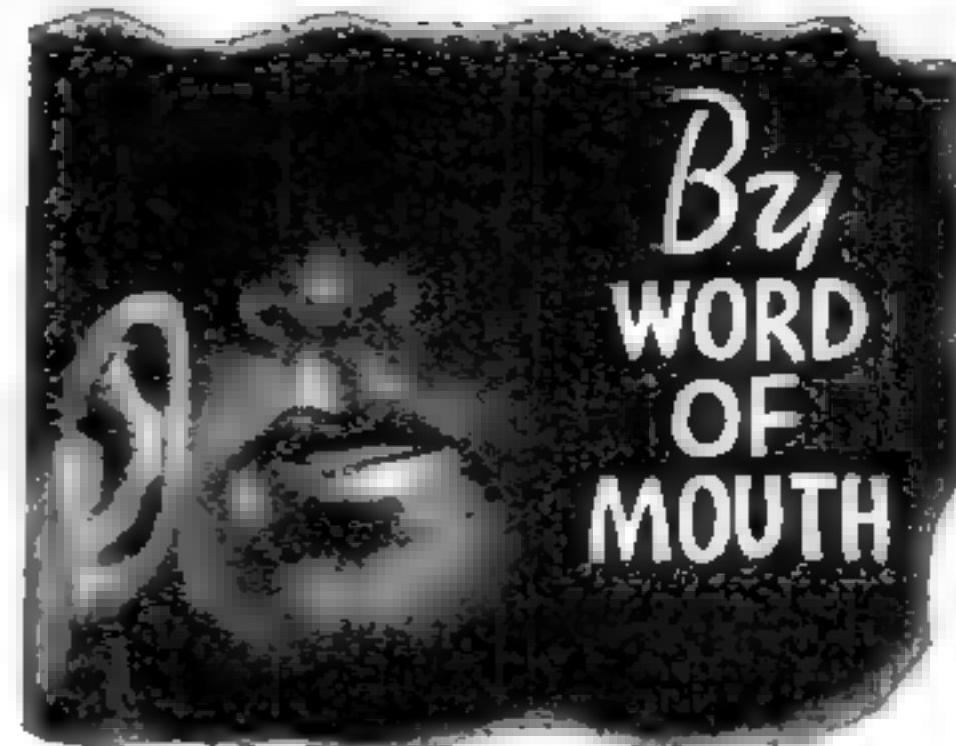
GALENA crystals, used in the pioneer crystal sets, are chemically the same as the black lead sulphide produced in the foregoing experiment. However, the precipitated lead sulphide, filtered off and compressed, would not work as a crystal rectifier in a radio set. If the substance is made in what is known as the "dry way," on the other hand, you will obtain a mass of the compound that does have electrical rectifying properties. To do this, heat lead shavings and sulphur together in a tin-can lid, stirring the mixture.

Particularly interesting to prepare is a peculiar form of zinc sulphide that emits light when it is subjected to friction. This property is called "triboluminescence," and the chemical is known as triboluminescent zinc sulphide. To make it, mix fifty grams (roughly ten teaspoonsfuls) of zinc oxide or zinc carbonate, fifteen grams of flowers of sulphur, and about a quarter of a gram of manganese dioxide. You can mix the first two with a spatula on a sheet of paper, and then rub in the manganese dioxide. The exact amount of the manganese compound is not critically important; simply add enough to color the mixture. Heat the preparation in a porcelain crucible, closed with its porcelain cover, and keep it red-hot for half an hour. When cool, the mass can be removed and pulverized.

To show the luminous property of this strange material, coat a card with varnish or with one of the water-white clear cements sold for general repairing, and sift the prepared powder upon the card. Let the adhesive dry thoroughly. Stroke the card with a hard object or with your finger nail, and you will observe a shower of sparks. For showmanship, you can add a cut-out picture of a lighthouse to the card, and draw your fingernail across the treated surface in the direction you want the beam to go, producing a striking and mystifying trail of light, and drawing gasps from your audience.

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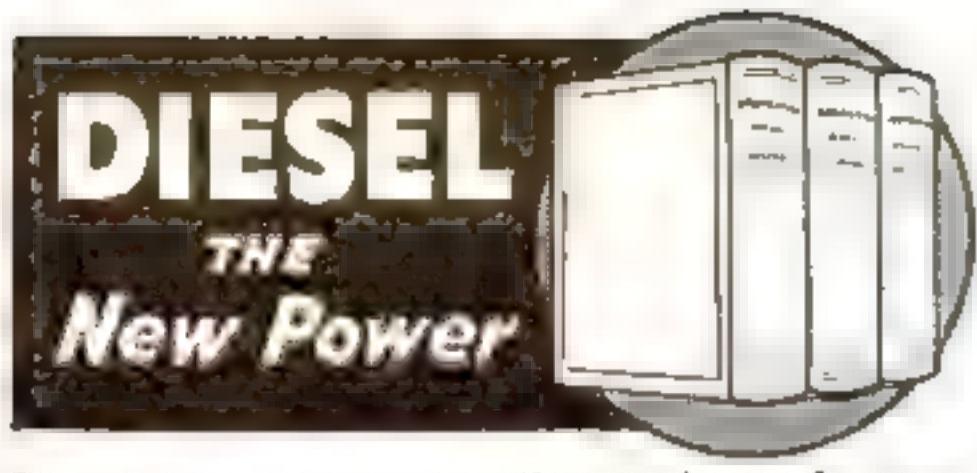
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WRESTLING TRICKS FOR SELF-DEFENSE

(Continued from page 25)



The "come-along" arm hold. This is handy for escorting a drunk or bringing in a captured thug

swing around, so your back is to him, with his arm over your shoulder. Then bend forward so quickly that he has no time to do anything about it.

The flying head lock, sometimes erroneously called the "flying mare," also can be used at times. With your back to your attacker, grasp his head by reaching over your shoulder with both hands. Bend over sharply as before, finishing the bend with a sharp downward tug at the back of his head.

If a man comes at you with his fists, cover up and duck down low. Watch for a chance to grab his left wrist in your right hand, and step forward, placing your shoulder at his crotch. Now rise, spin around a couple of times to make him lose his sense of direction, pull forward on his arm, heave upward with the opposite shoulder and arm, and crash him head first to the ground.

This is the "airplane spin," made popular by Jimmy Londos. It is as effective as it is spectacular, and easier than it looks. A man with normal strength can easily lift a heavy adversary off the ground if he gets well under him. The spins aren't necessary, but do aid in the maneuver's effectiveness by making your assailant dizzy. If he lands on a concrete pavement, it won't matter much whether he is dizzy or not.

IF SOME one takes a swing at you while you are seated, it is easy to handle him, provided both your feet aren't imprisoned under the table. Since it is usually a drunken bully in a night club or restaurant who makes such an attack, you probably will have warning enough to be ready for him

Pull your chair back from the table far enough to permit you to free yourself. When he starts his swing, ignore his fist. Dive forward quickly, and strike his leg sharply with your shoulder just above his knee. At the same time, clasp your hands together behind that same leg and strike his ankle a sharp forward blow. Keep on pushing forward while you are doing this. His attacked foot will be yanked from under him, and your weight, driving forward, will slam him backward on the floor with a bang.

You can upset a man while you are standing, in the same manner. I have had several mixed bouts, wrestler against boxer, and I never failed to bring my man to the mat with this trip. At the same time, I was crouched so low that he (Continued on page 117)

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A jujutsu trick—a straight-hand jab to the throat that will put the toughest out of action

WRESTLING TRICKS FOR SELF-DEFENSE

(Continued from page 116)

could not do any damage with his fists. The easiest way to handle a man who comes at you head down is to secure a reverse head lock.

Place your right hand on the back of his head as he comes in, and push it down against your waist, under your armpit. Circle his head with your left arm, your forearm along his jaw. Now, grasp your own right forearm and squeeze his head upward against your body, at the same time pushing against his left shoulder with your right hand.

The amount of pressure you apply depends upon just how much you want to hurt the other fellow. You not only can cause him great pain, but can render him unconscious by shutting off the supply of blood to his brain.

If someone circles your body from in front, for the purpose of attempting to squeeze you into submission, the hold can be broken by placing both hands under his chin and pushing upward and back. You can throw him to the ground at the same time by circling his near leg with one of your own and kicking forward against the other ankle.

But if you haven't acted quickly enough to break the hold in this manner, and you find your assailant leaning his weight against you with his chin protected on your shoulder, place your arms outside his and lock your hands. Then step backward quickly, while you drive upward against his stomach with your locked hands.

IF HE gets the body hold on you from behind, relax your chest muscles and lower yourself by bending at the knees, while at the same time pushing his arms up under your own armpits with both hands. Then, suddenly drive your elbows backward, at the same time expanding your chest muscles to the limit. The instant you are free, spin around quickly to meet his next attack.

Another way to break this hold, if it is low enough to enable you to bend forward from the waist, is to reach down and grab one of his ankles in both hands. Now straighten up suddenly and drive backwards. Your assailant will sit down hard with you on top of him. You will probably knock his wind out. His head may hit hard enough to stun him.

If you have thrown your man, and can turn him over on his stomach, grab one foot under your arm. Place that forearm under his ankle, bending the toe back against your armpit, and sit down on him. Whenever he struggles, put more pressure on the toe.

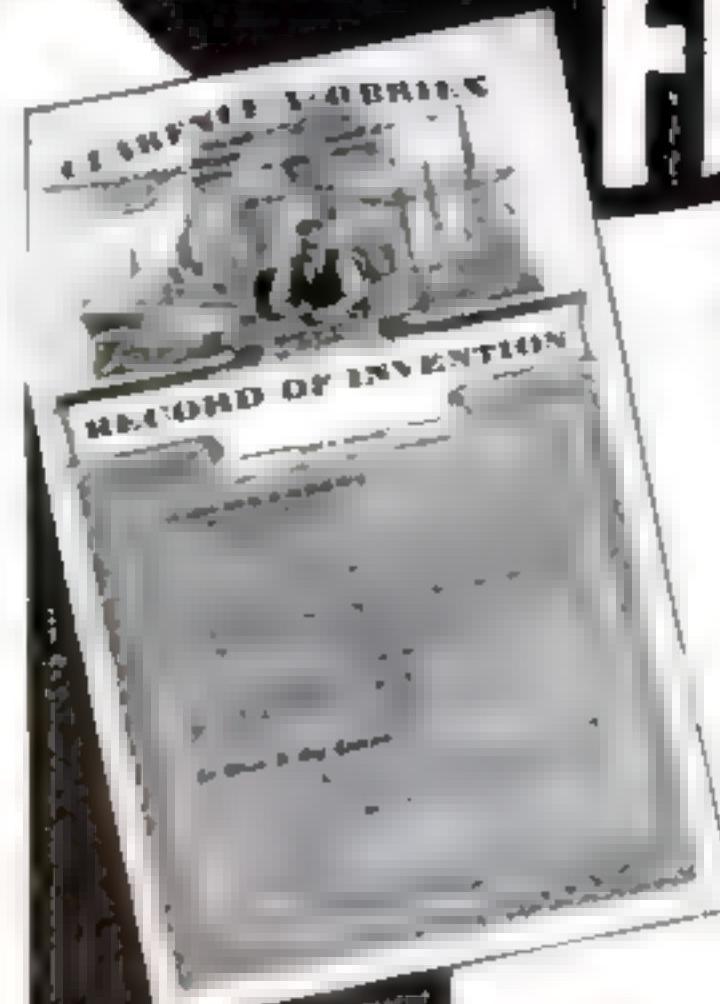
Better still, bend both his knees and hold his feet down with your thighs, while at the same time you grasp his chin with both hands and pull upwards. If he struggles hard, just throw more of your (Continued on page 118)

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WRESTLING TRICKS FOR SELF-DEFENSE

(Continued from page 117)

weight on his feet and tug harder at his chin. This hold is so painful that one application of pressure will convince even the most stubborn that it is futile to resist.

Another hold, which can be used either on the floor or standing, is to stick both hands under your assailant's armpits from behind, far enough so you can lock them back of his head in a "full Nelson."

Or the "reverse full Nelson" can be worked from in front. Stick your attacker's head between your knees, reach under his arms, and clasp your hands behind his back. The pressure comes on his neck when you pull upward on his arms.

IF YOU have captured a thug and want to bring him along with you, grab his right wrist with your own right hand, and turn his hand palm upwards. Place yourself alongside of him, and throw your left hand over his imprisoned arm, then under that arm above the elbow, grasping your own right arm with your left hand.

Your left forearm now acts as a fulcrum for the downward leverage you place on his arm with your right hand. Press his hand downward every time he attempts to struggle, and he will find the pain so great he will be glad to come wherever you care to lead.

In a situation so desperate that you have no compunction about causing serious injury to your opponent, the jujutsu expert has a sneaky little blow that is easy to land and extremely effective.

Straighten the wrist and fingers of either hand so they are stiff and jab the tips of the fingers smartly against your adversary's neck, catching him on either side of the Adam's apple. Placed just right, this blow can rupture the jugular vein. Even if it doesn't do that, it will cause such intense pain your attacker will think the top of his head has been blown off.

Don't be satisfied merely to read about these tricks. Get another man who is interested in the same subject, and practice each maneuver with him until you are proficient enough to apply a hold securely the first time you try. Against a real adversary, you will seldom get a second chance.

But be careful in practicing with a friend, especially with the disabling holds. You can get all the training you need, and still stop short of injuring your partner.

And, when practicing, master one hold thoroughly before passing on to the next. One or two tricks that you can apply with absolute confidence are worth more than a whole bag of stunts you are not quite sure of. The arm lock and "flying mare," thoroughly mastered, will give you a big edge over an untrained assailant, no matter how much stronger and heavier he is.

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BACK-YARD NAVIGATION

(Continued from page 53)

while the other makes a series of observations, beginning a few minutes before noon and continuing a few minutes after. You can then take the average result of all the observations to give you a more accurate determination of latitude, although, with a little experience, the operation of getting the shortest possible length of wire while sighting the sun, nail, and target hole, becomes an easy matter.

With nails, wire, and an almanac, this method of establishing your latitude can be used no matter where you happen to be on the face of the globe—at your home, lost in the north woods, or stranded on a tropical desert island. But you must know your east-and-west position, or longitude, as well as your latitude in order to determine exactly where you are. To do this, you will need a pocket watch, which we will assume is keeping Eastern Standard Time.

BY INTERNATIONAL agreement, longitude and time zones are figured from the "zero" meridian of longitude which passes through Greenwich, England. West of that meridian, clocks are set back one hour for each fifteen degrees of longitude. East of that line, time is one hour ahead for each fifteen degrees. Thus, when it is 5:00 p.m. in England, it is noon in Philadelphia, Pa., which is located on the seventy-fifth meridian west of Greenwich.

For purposes of illustration, let us suppose you are stranded on a desert island. Your first job will be to set up an improvised sundial on some level spot. This can be done by placing a carefully plumbed vertical stick into the ground. By marking the length of the stick's shadow on the ground, you can easily determine the moment of high noon by noting the shortest shadow. The shadow is shortest at noon, of course, because the sun is then at its highest point for the day.

At noon by your sundial, note the time by your watch. The difference between sun time and your watch will serve as a basis for calculating your approximate longitude. For example, if your watch (set for Eastern Standard Time) says one o'clock when it is noon by the sun, you know that you must be in a longitude whose time is one hour behind that of the Eastern zone. This would place you about fifteen degrees west of the Eastern zone, or seventy-fifth meridian—somewhere near the ninetieth meridian of longitude—approximately that of New Orleans, La., or St. Louis, Mo.

For each twenty minutes that your watch is behind the time of your sundial, count your position as five degrees of longitude west of the seventy-fifth meridian, the central meridian running through the Eastern time zone. This means one degree of longitude for each four minutes of time.

IN THE example just mentioned, we are assuming that the day is December 22, for on that date and three others during the year (April 15, June 15, and September 1), sundial time and standard time agree. To get an entirely accurate value at all other dates in the year, the comparison of sun and watch time should be corrected by adding or subtracting a certain number of minutes known as the "equation of time." This time equation is given for each day in the year in any good nautical almanac.

Although his results will not be as accurate as those of an experienced navigator working with delicate instruments, any layman can determine his latitude and longitude with the simple materials described here. The accuracy of his findings will depend solely on the care with which he makes his observations and measurements.



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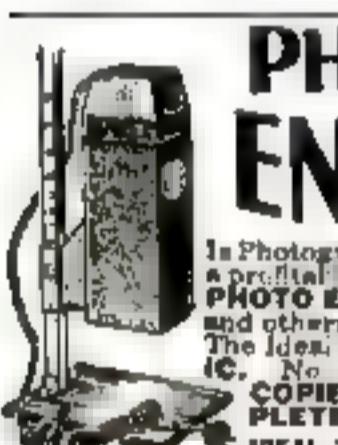


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GIVE YOUR CAR THESE SAFETY TESTS

(Continued from page 60)

glued to the bottom end so the block won't just slide along on the floor instead of tipping over."

"Gosh!" Donan exclaimed. "I don't want to do all that figuring. Give me the actual dimensions of this block, and I'll make one just like it." He pulled out a notebook and a pencil.

"This is just a piece cut off an ordinary fir two-by-four exactly three and twenty-five thirty-seconds inches long. I sawed a slice off one edge to get the width down to exactly two and twenty-seven thirty-seconds of an inch. The usual dressed thickness of a two-by-four is one and eleven sixteenths of an inch, and if you'll check those dimensions you'll find they fit the specifications so near that the difference doesn't matter."

"I'LL take your word for it," Donan laughed, as he finished writing down the figures. "I'm going to make me a block like that right away—and, believe me, I'm going to see that my brakes are kept so I can roll that block over any time from the edgewise position. How about adjusting those brakes right now?"

"Your saying that old crock was maybe safer than my car, kind of got under my skin," Donan observed, as Gus got his tool kit and set to work on the brakes. "Anyhow, the motor in that old baby isn't as safe as this one."

"Certainly it is," Gus grunted, as he jacked up the rear of the car. "So long as the motor isn't so loose in the frame that it's likely to drop out in the road, it doesn't matter how rotten it runs or how much noise it makes—from a safety standpoint. All it can do is stop, and while that may be a blamed nuisance, it won't put your life in peril unless you happen to be crossing a desert or something like that."

"No," Gus continued, "the fact that the motor is on the blink, the paint is peeling off, the mud guards are full of dents, and the upholstery is sprouting whiskers, have nothing to do with safety. Safety hinges on the mechanical condition of the running gear—especially the steering part of it—and of the brakes."

"It's a pity there aren't some simple ways to test the running gear like this block you use for testing brakes," Donan remarked.

"Some of the tests you can make yourself are even simpler," Gus answered, as he lowered the rear of the car and pushed the jack under the center of the front axle.

"LOOSENESS in the steering gear may be a sign of coming trouble," he added, as he left the jack and came around to the side of the car. "Anybody can test for steering-gear looseness just by jiggling the steering wheel back and forth like this while you watch the front wheel to note the point where the slack is taken up and the wheel just starts to turn. If there is much over an inch to an inch and a half of play with the wheels in the straight-ahead position, then watch out, especially if the play develops quite suddenly. It may mean that something is coming loose in the steering mechanism, maybe a ball joint coming apart, or a loosening of the adjusting nuts on the rod that links the wheels and holds them in line. Of course, if the looseness is really due only to natural wear of the parts, and if it isn't too bad, it won't cause an accident, unless you're in the habit of driving fast. In that case, you won't have as close control over the steering as you should, and the looseness may favor the development of shimmying."

"Let me see how much play there is now," Donan said, as he reached for the steering

wheel. "Then I'll be able to judge if any more play develops."

"Here's another simple test," Gus said, as he started to raise the jack very slowly. "Watch the wheels, now. If the king-pin bearings are tight, and the wheel bearings perfectly adjusted, the wheels will move up just as though they were solidly attached to the axle. If either one sags, then you should grab the tire at the top after you get it clear of the ground, and shake it in and out to find out whether the looseness is in the king-pin bearing or in the wheel bearing. A little looseness in either bearing doesn't necessarily mean danger, but it is well to check it once in a while to see that it isn't getting worse."

"I can do that with my own jack just as well, can't I?" Donan asked.

"Sure," Gus replied. "Take one side at a time."

"THERE'S another test you can make when you have the front wheel jacked up. That is to spin it to see that the front-axle bearings are in good shape. If the wheel spins freely, with only a faint, smooth kind of a roar from the bearing, then everything is probably in fine shape, but if you hear any sounds of grinding or grating, especially if the wheel seems to catch here and there as it spins, then it's quite likely that one of the roller bearings has cracked. Often a roller bearing can go all to pieces without jamming the wheel, but once in a while a broken bearing locks the wheel. If that occurs suddenly while you're going fast, lots of unpleasant things can happen."

"How do you adjust a front-wheel bearing when it gets loose?" Donan asked.

"That's simple enough," Gus explained. "Just pull the cotter pin and turn the castellated nut on the end of the axle till the bearing just begins to bind, then back it off enough so that the next slot in the nut will line up with the cotter-pin hole in the axle—and don't forget to replace the cotter pin!"

"While we're on the subject of axles," Gus went on, "the seating of the rear hubs on the tapered ends of the rear axles should be checked once in a while. There shouldn't be any looseness at all. If there is, the continual banging the key gets, every time you take your foot off the throttle and put it on again, will eventually shear off the key and you'll have to be towed home. Or, what is still worse, it may snap the axle—and losing a wheel doesn't make for safety!"

"ANYTHING else that can affect your safety?" Donan asked, as Gus finished with the brake adjusting.

"No car is safe with a windshield wiper that is on the verge of not operating at all," Gus grumbled, as he put away his tools.

"But how can you check the condition of a windshield wiper? Either it works or it doesn't, I'd say."

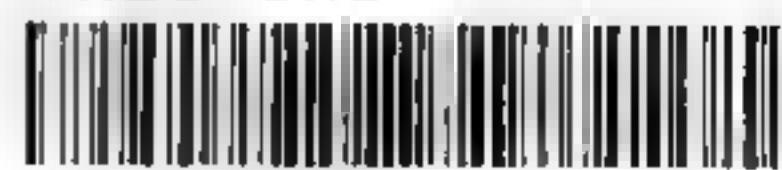
"What's the matter with testing it now and then, to see how much pull it has?" Gus suggested. "If your wiper has power enough to drag the rubber blade back and forth across a dry windshield, you can bank on its working in the rain. But be sure to clean the windshield before you test the wiper on the dry glass, or the grit will make troublesome scratches."

"That's a good tip," Donan agreed. "I'm going to test my wiper every time I get the windshield cleaned."

"And don't forget your lights," Gus added, as a parting suggestion.

"Now you're kidding, Gus!" Donan laughed. "Anyone who drives with rotten lights certainly is putting an awful strain on his own good luck!"

This One



BJ1B-TUY-YHJ2

EASILY MADE MIDGET ALL-WAVE RECEIVER

(Continued from page 59)

ed antenna and a carefully installed lead-in. If desired, the commercial coil-switching unit can be eliminated and ordinary four-prong plug-in coils used instead. If this is done, however, the connections to the prongs of the coils must be checked carefully. To operate, they must agree with the circuit connections to the four-hole socket. The specifications for the rest of the parts, which should be adhered to closely, are as follows:

C₁—Midget variable condenser, .00005 mfd.
C₂—Fixed condenser, .0001 mfd.
C₃—Fixed condenser, .0001 mfd.
C₄—Midget variable condenser, .000015 mfd.
C₅—Midget variable condenser, .00014 mfd.
C₆—By-pass condenser, .1 mfd.
C₇—By-pass condenser, .5 mfd.
C₈—By-pass condenser, .1 mfd.
C₉—Fixed condenser, .01 mfd.
C₁₀—Fixed condenser, .0005 mfd.
C₁₁—Filter condenser (in filter block), 10 mfd., 35 volt.
C₁₂—Filter condenser, 16 mfd., 200 volt.
C₁₃—Filter condenser, 8 mfd., 200 volt.
C₁₄—Filter condenser (dual 8 mfd. with sections in parallel), 16 mfd., 200 volt.
R₁—Resistor, 800 ohms, 1 watt.
R₂—Resistor, 2 meg., $\frac{1}{2}$ watt.
R₃—Variable resistor, 0-100,000 ohm.
R₄—Resistor, 100,000 ohm, 1 watt.
R₅—Resistor, 50,000 ohms, 1 watt.
R₆—Resistor, 750,000 ohms, 1 watt.
R₇—Variable resistor with switch, 0-500,000 ohm.
R₈—Resistor (in power cord), 330 ohm.
R₉—Resistor, 2000 ohm, 1 watt.
L₁ and L₂—Coil-switching unit.
T₁—Audio transformer, 3-1 ratio.
Ch.—A.C.-D.C. filter choke, 400 ohms or less.

Miscellaneous—Metal chassis, two seven-prong sockets, wire, nuts and bolts, tubes, speaker, etc.

BALD EAGLES THRIVE IN LOWLAND REGIONS

BALD EAGLES, generally associated with lofty mountain-top nests, are more numerous in flat seacoast regions, it was stated at a recent meeting of the American Ornithological Union. Recent studies indicate that more bald eagles inhabit the lowlands of southeastern Florida than any other single region of similar area in the United States. Another favorite habitat of the bird, it was reported, is the shore of Chesapeake Bay, in the states of Virginia and Maryland.

READERS' HANDS PICKLE LEATHER BOOK BINDINGS

WHY do the leather bindings of library books that are frequently used last longer than the bindings of books seldom called for? To find out, chemists of the U. S. Department of Agriculture made a study of the problem, and recently announced that salt originating from the perspiration on the hands of readers had a preservative action on the leather book covers.

EXTREMES OF CLIMATE FOUND CLOSE TOGETHER

PROBABLY nowhere in the world is there a greater contrast between extreme wet and dry areas than in the region surrounding Mt. Waialeale, on the island of Kauai, Hawaii. At the top of the mountain, U. S. Weather Bureau instruments record an average annual rainfall of 451 inches, while at sea level, only fourteen miles away, the yearly rainfall is only about eleven inches.

PATENT FACTS

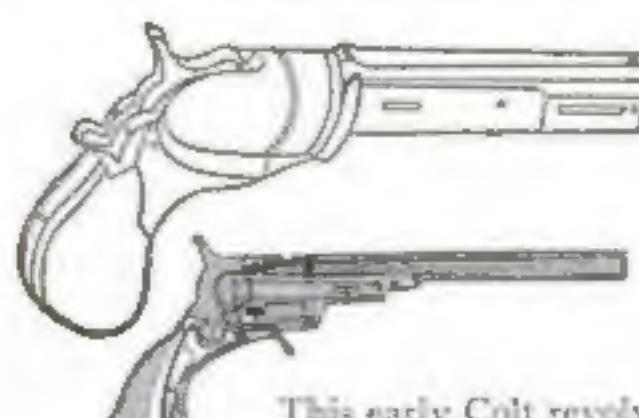
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INTERESTING INVENTIONS

An Early Revolver



This early Colt revolver was patented in 1836. Samuel Colt, its originator, was known as the boy inventor. While still a lad he ran away to sea and whittled the first model of a repeating fire-arm out of wood during his leisure moments on shipboard. Colt was persevering. Three years later, in 1839, he had made improvements to produce the second revolver shown here. It was used in the Mexican War with excellent effect. By 1852, Colt had the largest firearms factory in the world. Colt died a very wealthy man.

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Aladdins of Hollywood

(Continued from page 31)

But the flakes you saw falling are quite different—the newest thing in movie snow. They're chicken feathers, chopped in a meat grinder just small enough to filter through a half-inch wire screen."

"Chicken feathers!" I exclaimed.

"Yep. We've been experimenting with them a long time, and have found that, so long as we keep the size uniform, they float down like the real article. Not long ago, before we finally perfected the cutting process, some came through too fine. When we'd turn them loose, they'd float and fill the entire stage. Now we can control the feathers over one small spot—provided there are no drafts to scatter them."

"But the gypsum snow—" I asked, "how did you shoot that stuff up in a shower when the trunk struck it?"

"Very simple. See that pipe leading off-stage? That fellow hit the compressed air at the instant the trunk reached the snow."

But the men in the property department are not always concerned with large effects. Often, small properties cause them more anxiety than the seemingly more complex major scenes. The featherless duck, for instance.

On the other side of Hollywood, at the Hal Roach studios, Charles Oelze got that order for an "Our Gang" comedy.

"The kids were supposed to be fighting over a duck they had caught," he told me. "Suddenly the bird, stripped of its feathers, escaped from among their legs and ran, quacking, down the street. Now, we've never been cruel to animals or birds; of course, the bird still had its feathers. All I had done was to cover a second duck with a bodice of skin-colored surgical rubber. When the fight reached its height, an alert assistant, hidden from view of the camera, exchanged birds. That's all."

ON ANOTHER sound stage the other day, I saw thirty men apparently sweltering in steam baths. For the better part of two days they had been sitting in those small wooden cubicles, bathed in steam. Yet, thanks to the ingenuity of a property man, all were nearly as cool as the onlookers. Since steam would have cooked them red as lobsters after only a short exposure, the Aladdin of that particular studio gave each actor a small pan filled with cracked "dry ice." Steam flowed from pipes into the pans, and, when it emerged, was cool as a cucumber. Electric fans placed on the floors of the cabinets forced the cool stream upward around the men's faces, thus providing the desired effect with a minimum of discomfort.

Ordinarily, machines which create artificial winds are noisy. Ever since sound first came to the movies, directors have despaired of producing breezes on sound stages without objectionable noises. Only recently did an alert property man succeed in creating noiseless winds, by hooking in series two closed-circuit blowers and directing the air current into the stage through large cloth ducts. Now, flowers and shrubs may be made to rustle directly before the camera's eye, with no whirring or beating of propellers to mar the sound track.

Whether the call is for cold steam, indoor winds, or cotton that will not burn, these wizards behind the scenes give the director what he wants. Seldom do they report failure. Shooting was progressing on "General Spanky," when a threatened change in weather on the Sacramento River, to be used for Mississippi River scenes, required an early departure for location. Forty bales of cotton, of the same size and wrappings as might have been seen along the great river three quarters of a century ago, had to be supplied in forty-eight hours. And, as a safety measure,

they had to be fireproof.

The property man visited the studio library, studied photographs and technical description of cotton bales of that period. He found they weighed 600 pounds and were wrapped in large-textured burlap and bound with broad, metal bands. Back in the prop shop, an hour later, he was giving orders for their construction. Wooden boxes supplied the form, layers of real cotton met the camera's eye. Silicate of soda and salt, sprayed on under pressure, provided the fire-resistant quality. Next morning, a drayman loaded the forty bales and started them on their way to the river location. There they were stowed on a steamer fitted with false sides and hull which had been blackened by an acetylene torch at the studio.

Tear gas once offered an unusually difficult problem, until a property man who had become expert in the handling of chemicals devised a method of delivering a harmless but realistic gas at the desired spot. Now, when you see the cops chasing a villain and firing what passes for tear gas, you can be assured that the bombs, made of plaster and resin, are loaded with titanium tetrachloride. In one

recent picture, thirty of these bombs were thrown at an actor hiding in the top of a building, but, aside from choking slightly, neither he nor the technical crew suffered any ill effects.

Sometimes, a single idea may be adapted to serve several purposes. The camera cannot see a bullet as it ploughs through a wall or a knife as it speeds through the air. But the illusion of sight can be created.

IN A recent circus picture, an expert knife thrower displayed his skill as he drew a circle around his assistant, standing twenty paces distant against a board, with eight daggers. The camera, placed to the rear of the knife-wielder, showed the weapons sweep forward. Simultaneously, a property man, standing behind the camera, pulled invisible wires which released wooden daggers concealed in the wood. Powerful rubber bands threw the hilts out, while wooden stops caught them, leaving the points apparently embedded in the front of the board.

To show the effect of bullets in a gang-fight scene, the walls of a make-believe room were first drilled, the holes being refilled with dust and a thin coating of plaster. Then, as sound effects run off from film taken from the studio library simulated gunfire, a property man poked the blackened ends of pencil-size wooden plungers through the wall. Audiences thought they actually saw the bullets ripping up the room.

Scenarists think of the situations, gag men write into the script particular stunts; then it's up to the property men to provide working means for carrying out the ideas, no matter how far-fetched they may be.

It was a gag man who decided that one comedian should pull the ear of another, which should snap back against his cheek, causing his jaw to pulsate as though from toothache. Oelze made five rubber ears, and fitted each to the actor's head by steel bands and liquid adhesive, before he created one which would stretch out and snap back into place without becoming distorted.

Next, he attacked the problem of a pulsating cheek. This proved somewhat more simple, and was solved by placing a toy balloon in the man's mouth. A small hose leading out of the corner of his mouth, on the side away from the camera, enabled an assistant to provide the pulsations at any desired rate by squeezing a bulb.

These men who build and put the various properties through their paces, ask for help only when they're called upon to burn down a large structure—and then only because the law requires that firemen and plenty of apparatus be present to save the studio in case the flames get out of hand.

Burning a three-story building is potentially the most dangerous job these wizards ever undertake, one which requires not only careful control of each individual fire but also split-second timing. For dramatic effect, a building must be entirely afire within sixty seconds; and for safety, those in control must be able to quench the flames at the drop of a hat.

When a fire sequence is scheduled, a corps of property men and carpenters pours onto the set, laying copper pipes to each spot where an outbreak is to occur. Small charges of black powder are tied to electric fuses. When cameras begin to roll, a property man swings a handle across a board, making electrical contacts in rapid succession. The powder explodes, and a combination of air and rubber-solvent fluid, forced under high pressure to the various points, roars upward in vivid flames to give the desired realism. But at the turn of a valve, the flames subside and no damage is done.



Bales of cotton for a Mississippi River scene. The man is spraying a fireproofing chemical

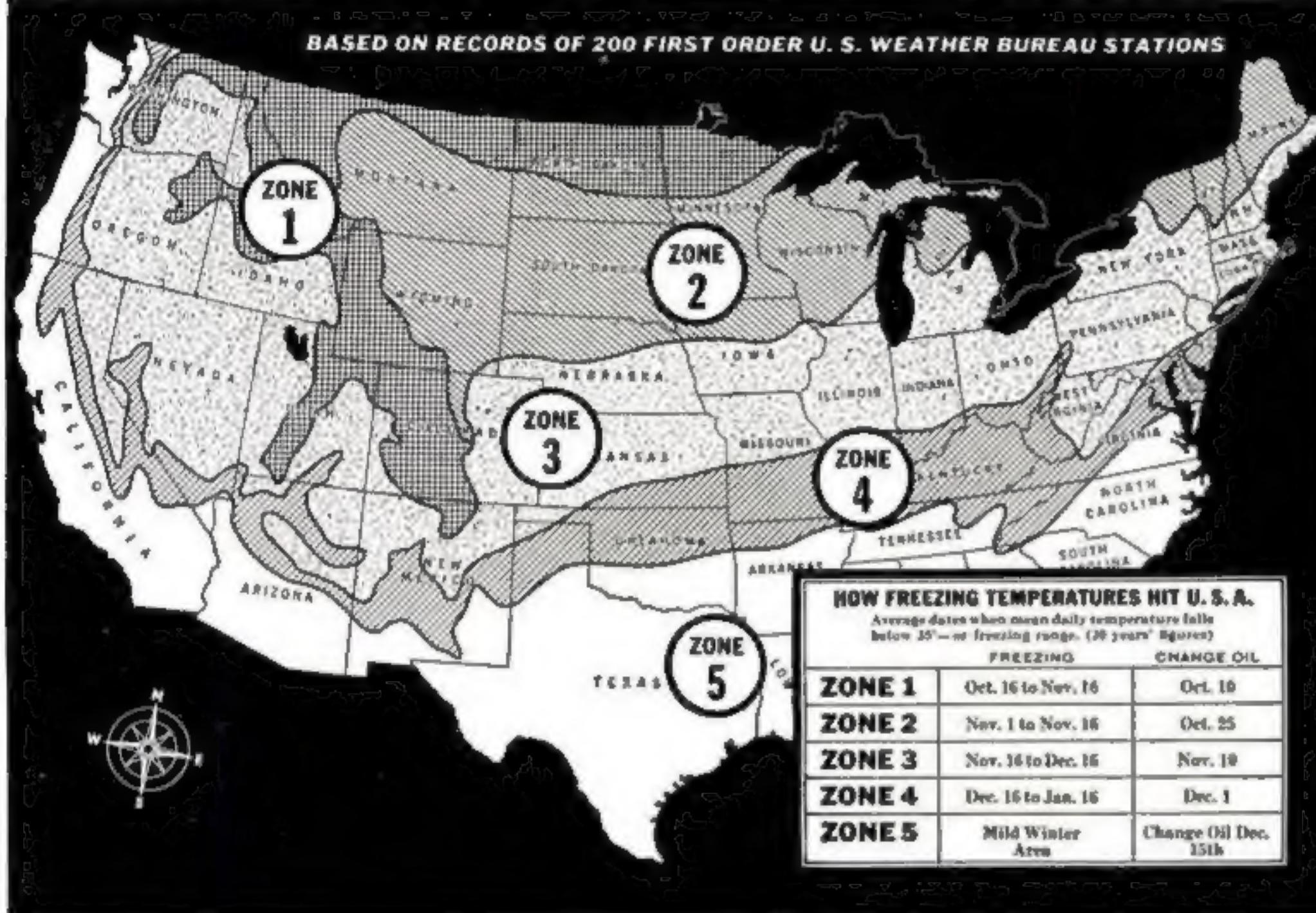


This complicated switchboard sets off charges of powder to imitate the spreading of a fire

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Follow the Official Winter Map (left, above) for the correct time to drain and refill with free-flowing Mobil oil Arctic.

SHIFT EASY WITH MOBIL OIL WINTER GEAR OIL

Summer-grade gear oil stiffens with cold, causes hard shifting and clashing wear. Get Mobil oil Winter Gear Oil when you change your crankcase oil.

STOP WHEREVER YOU SEE THESE SIGNS FOR AMERICA'S

FAVORITE WINTER OIL



